2.3 Portland Cement:

Portland Cement shall conform to ASTM C 150, Type II for concrete used in manholes. Air-entraining admixture conforming to ASTM C 260 shall be used with Type V cement.

2.4 Portland Cement Concrete:

Portland Cement Concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete thrust blocks, for cradle and encasement, or for concrete blocks for manholes. Concrete used for thrust blocking and cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moistureless for 7 days.

2.5 Precast Reinforced Concrete Manhole Sections:

Precast Reinforced Concrete Manhole Sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, or an approved mastic or rubber gasket, or an approved combination of these types.

3. INSTALLATION:

3.1 Manholes:

Manholes shall be constructed of glass-fiber-reinforced polyester or precast concrete rings, with cast iron or ductile iron frames and covers, as indicated. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile-laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe connections shall be made to manhole using water stops, standard o-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection. list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot
Free drop inside the manholes shall not exceed .1 foot 6 inches, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels, and drop manholes shall be constructed whenever the free drop would otherwise be greater than 1 foot 6 inches

3.2 Manhole Steps:

When the depth from top of cover to invert of main sewer exceeds 12 feet, manholes shall be provided with manhole steps. Installation shall be according to manufacturer's recommended procedures.

3.3 Jointing and Plastering:

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer.

3.4 Frames and Covers:

Unless otherwise indicated, the frames and covers shall be so set that the top of the cover will be flush with finished pavement grade or 2 inches higher than finished grade in unpaved areas. Where watertight is specified, a watertight insert shall be installed. These units, made of high density polyethylene, equipped with air release and vacuum valves, and with a configuration such that the lip will rest on the seating surface of the manhole frame and be supported thereby, and also such that the cast iron cover, when tipped at 90 degrees to its normal position, will not touch the insert's bowl.

3.5 Testing:

3.5.1 Smoke-Testing:

The reach of sewer in which the repair (or repairs) has been made shall be isolated by plugging the upstream and downstream manholes as necessary not only to temporarily eliminate the flow of sewage through it but also to prohibit the smoke from entering other reaches of sewer. Smoke shall then be introduced before backfilling the trench and the repaired area, into one of the manholes or adapted for smoke testing sanitary sewers and approved by the Contracting Officer. The repaired area shall then be observed for the emergence of smoke for a period of is minutes. If none can be seen, the repair will be deemed to have passed the test.

3.5.2 Exfiltration-Testing:

This method may be used only on sewers laid on grades less than 1.00 percent. Water, colored with a bright-colored dye approved for usage in testing, is introduced into the pipe so as to impose a 2 foot static head over the top of the pipe at the point of repair when the pipe in the lower manhole is plugged. Observations shall then be made by the Contracting Officer to determine if leakage of the colored water occurs at the repair point. Care shall be taken, when this method is used, that:

a. Not more than 4 feet of static head are induced on the main lower end of the reach.

b No back-up problems are caused in downhill service lines.

SECTION 02726

MISCELLANEOUS WORK IN REHABILITATION
OF SANITARY SEWERS

PART 1-GENERAL

1.1 SCOPE:

This section of the specifications covers miscellaneous work related to the rehabilitation of repair of existing sanitary sewers and appurtenances.

1.2 GENERAL REQUIREMENTS:

All of the work described herein is considered to be subsidiary to items of work covered in other sections of these specifications. Furnish all labor, materials, supervision and equipment necessary for maintaining the by-pass pumping system in continuous proper working order for the duration of sewer repairs/replacement. Obtain approval of discharge location for by-pass pumping system prior to commencing work. Under no condition will raw sewage be allowed to discharge in open ditches, streets or storm sewer systems in any way that would create unsanitary conditions or interfere unduly with the use of streets, private driveways entrances or residences. whenever flows in a sewer line are blocked, plugged or bypassed, sufficient precautions must be taken to protect the sewer lines from damage. Ensure that sewer line repair and/or by-pass operations do not cause flooding or damage to public or private property being served by the sewer lines involved in the repair.

PART 2 - PRODUCTS (NONE)

PART 3 - EXECUTION

3.1 PROCEDURES:

Isolation of sanitary sewer reaches and/or manholes:

The purpose of "isolation" is to temporarily stop or divert the flow of sewage originating upstream of the reach of sewer upon which work is to be performed from passing through it while the work is in progress.

3.1.2 Short-term Isolation by Plugging:

This may be accomplished by installing an inflatable, tightly fitting pneumatic plug in the pipe at the manhole at its upper end or by other approved methods.

3.1.3 Isolation by By-pass Pumping:

When sewage flow quantities entering the upper manhole are large and/or when the time of interruption of flow through the reach is lengthy enough to cause backup which adversely affects the operation of upstream mains and service lines, by-pass pumping is necessary. By-pass pumping is the transfer of raw sewage entering an upstream manhole around the affected reach of the sewer to another manhole or some other point downstream of it. By-pass pumping shall continue as long as is necessary to complete the work in or on the affected reach. Discharge of the by-passed sewage must be into an operating sewer for transportation to the treatment plant. No discharge will be permitted onto surface areas.

3.1.4 Procedures and Methods:

Required procedures for use and operation of by-pass pumping system:

a. Prior to beginning sewer repair/replacement, demonstrate pumping system is in good working order.

b. Prior to isolating sewer manhole and/or line segment for beginning work have all materials, equipment and labor necessary to complete sewer repair/replacement on job site.

c. Locate by-pass pumping suction and discharge lines so as not to cause undue interference with the use of streets and parking lots.

d. Plug off and pump down sewer manhole or line segment in designated area. Maintain sanitary sewer system so that surcharging does not occur.

e. Complete sewer repair/replacement as quickly as possible. Satisfactorily meet all tests and repair all deficiencies as specified prior to returning flow to sewer manhole or line segment.

3.2 TESTING:

The contractor shall perform tests on the repaired, rehabilitated or new facilities as described in the pertinent sections of the specifications. If the work should fail to pass the tests, it is the contractor's responsibility to re-perform the work and re-test it at his own cost with no additional compensation being paid. when difficulty is experienced in determining the exact location or cause of leaks the Contracting Officer may require additional smoke testing. The performance of tests for this purpose in no way relieves the contractor of the responsibility to perform the testing described elsewhere in these specifications.

SECTION 02727

SEWER LINE CLEANING PART 1-GENERAL

1.1 SCOPE:

This specification covers the general requirements for sewer line cleaning. The contractor shall have the option of cleaning by hydraulic scouring and rodding or a combination of the two.

2. APPLICABLE PUBLICATIONS:

The following publication of the issue listed below, but referred to thereafter by the basic designation only, forms a part of this specification and supplementary detailed sections to the extent indicated by references thereto:

Water Pollution Control Federation (WPCF)

No. 7 Manual of Practice - Sewer Maintenance

3. SUBMITTALS:

3.1 The contractor shall submit a proposal of desired method of cleaning detailing equipment, personnel, and materials needed.

3.2 Certificates of Compliance: Upon completion of work, the contractor shall furnish a certificate certifying that the sewer has been cleaned in compliance with specified requirements.

3.3 Deviations: Upon completion of cleaning, the contractor shall furnish a list of any deviations discovered between the contract drawings and the existing sewer lines. The contractor will also provide a list of any obstructions encountered.

4. HYDRAULIC SCOURING:

4.1 Cleaning Equipment:

The contractor shall furnish all equipment, accessories, attachments and parts necessary to accomplish the work. This equipment shall include but is not limited to the particular equipment specified.

4.1.1 Booster Feed Pump:

Pump shall be centrifugal, variable speed, of proper flow and head characteristics, electric power or engine driven, with maximum developed speed of 1750 rpm.

4.1.2 Tubing and Piping:

Fixed tubing and piping shall be of the lengths and sizes required with joints which will limit the amount of leakage to a minimum. Joints for flexible tubing shall be survival-type to avoid excessive twisting and possible pinching. All tubing and piping shall be secured in place during course of work, and protected against traffic damage.

4.1.3 Nozzle:

Flushing nozzle shall be of backward delivery type, with jet of water of circular configuration acting on the full inside periphery of the pipe. Nozzle shall not be of the rotating type. Nozzle may deliver water continuously or in surges.

4.1.4 Pipe Plug:

Pipe plug shall be inflatable type, shall stop all flows from passing in either direction at high static heads and shall be of the proper size.

4.1.5 Water:

Contractor shall furnish water to be used in the cleaning operation. Potable water supply shall not be used unless an approved backflow preventer is provided for the cross connection.

4.1.6 Accessories required to complete the work shall be provided.

4.2 Procedure:

4.2.1 Pipe plug shall be inserted and inflated at downstream pipe to avoid waste and debris entering downstream portion of sewer.

4.2.2 Interior walls of pipe shall be scoured with high pressure water through nozzle.

4.2.3 Water pressure shall be controlled to avoid water overflowing at manhole and flowing up service connection and overflowing at catch basin.

4.2.4 Collection of Washwater:

Washwater containing waste and debris shall be collected through the use of the suction pump at the same manhole where nozzle was inserted, when operation is in the upstream direction.

4.2.5 Disposal of Washwater and Waste:

None of the washwater containing waste and debris shall be disposed of or discharged in any form at ground level, on streets, in ditches or in same or adjacent sewer. All spills shall be contained, removed and cleaned up immediately after occurrence. Water may be screened and recycled in order to minimize supply amount.

5. RODDING:

5.1 Equipment:

The contractor shall provide all equipment, accessories, attachments, and parts necessary to accomplish the work. /This equipment shall include, but is not limited to, the particular equipment specified.

5.1.1 Cleaning machine shall be power operated, variable speed, of required horsepower, Cleaning machine shall have a manually controlled powered cable feeder.

5.1.2 Cable shall be of the proper length and design marked in .3 m (one foot) intervals. Cable shall have proper fittings, as required for adding more cable length.

5.1.3 Redding tool shall be of the proper design for the individual circumstance and shall be of the proper size to suit the inside diameter of the sewer line.

5.1.4 Feed chute shall be of the length and size required for insertion of cable through manhole invert. Chute shall originate at the cleaning machine and extend not less than .6 m (2 feet) into the pipe to be cleaned.

5.1.5 The first cable joint, and that which is closest to the cleaning machine, shall be a universal joint. All other joints shall be secured with a pin or cotter pin and restricted in torsional movement.

5.2 Procedure:

5.2.1 Cleaning:

Rod and cable shall be inserted in the pipe at invert of manhole, in the downstream direction, attached to cable and machine, and the interior of the pipe rodded until all obstructions are removed.

5.2.2 Effects of cleaning shall be observed at downstream manhole.

5.2.3 Waste and debris stemming from the rodding operation shall not be allowed to wash downstream and shall be removed at the first downstream manhole.

5.2.4 Upon completion of the rodding operation the sewer line shall be flushed. All materials 2 inches or larger in any direction shall be removed.

SECTION 02730

SANITARY SEWERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN RAILWAY ENGINEERING ASSOCIATION (AREA)

AREA-03	(1994) Manual for Railway Engineering (Fixed Properties): Chapter 1, Roadway and Ballast

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74	(1994) Cast Iron Soil Pipe and Fittings
ASTM A 123	(1989a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM C 14	(1994) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 33	(1993) Concrete Aggregates
ASTM C 76	(1994) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 94	(1994) Ready-Mixed Concrete
ASTM C 150	(1994) Portland Cement
ASTM C 260	(1994) Air-Entraining Admixtures for Concrete
ASTM C 270	(1994) Mortar for Unit Masonry
ASTM C 425	(1991) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1994) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 478	(1994) Precast Reinforced Concrete Manhole Sections
ASTM C 564	(1993) Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM C 700	(1991) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 828	(1990) Low-Pressure Air Test of Vitrified Clay Pipe Lines
ASTM C 924	(1989) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 972	(1982; R 1990) Test Method for Compression-Recovery of Tape Sealant
ASTM D 412	(1992) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers Tension
ASTM D 624	(1991) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1992) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2680	(1993) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1993) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 2996	(1988) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(1990) Centrifugally Cast Fiberglass" (Glass-Fiber-Reinforced-Thermosetting -Resin) Pipe
ASTM D 3034	(1994) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1992) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3262	(1993) "Fiberglass" Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe
ASTM D 3350	(1993) Polyethylene Plastics Pipe and Fittings Materials

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1991) Hazardous Chemicals Data
NFPA 325M	(1991) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1990) Identification of the Fire Hazards of Materials

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6	(1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe
UBPPA UNI-B-9	(1990) Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch)

1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 5 feet outside the building to which the sewer system is to be connected. Material damaged by the Contractor shall replace and shall redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

1.3 MEASUREMENT AND PAYMENT

Measurements and payments will be based on completed work performed in accordance with the drawings, specifications, and the contract payment schedules. No payment will be made under this section for

excavation, backfilling, or grading. Payment for such work will be made under Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

1.3.1 Pipe

The length of pipe installed will be measured from center to center of manholes and from the center of sewer to the end of the service connections without deduction for fittings or diameters of manholes and will be paid for according to the applicable contract unit price per foot for the size of pipe. No extra payment will be made for bends.

1.3.2 Manholes

The depth of manholes will be measured from the top of the cover to the invert of the outlet pipe. Manholes will be paid for according to the applicable contract price each for the depth of manhole indicated in the payment schedule. No extra payment will be made for drop manholes except that the concrete used for encasing the drop connection will be measured and paid for according to the contract unit price per cubic yard of concrete for encasement, and no extra payment will be made for pipe fittings required to make connections to manholes.

1.3.3 Concrete

Concrete used for pipe encasement, cradles, and similar supports, indicated or required for reasons other than faulty construction methods or negligence of the Contractor, will be measured and paid for according to the contract unit price for concrete for encasement and cradles.

1.3.4 Connections to Existing Manholes

Connections to existing manholes will be paid for according to the applicable contract unit price per connection for each required size of pipe, which shall be full compensation for all necessary cutting, shaping, pipe fittings, and concrete, except that concrete required for encasing or cradling pipe outside the manhole will be measured and paid for according to the contract unit price for such concrete.

1.3.5 Wye Branches

Wye branches installed in new sewers will be paid for according to the applicable contract unit price for the size indicated in the payment schedule. This will be in addition to the price per foot of straight pipe.

1.3.6 Connections to Existing Sewers

Connections to existing sewers where new wye branches to cut-ins are required will be paid for according to the contract unit price

cell Class 334433C. The pipe stiffness shall be greater than or equal to 1170/D for cohesionless material pipe trench backfills.

2.2 FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

2.2.1 Concrete Pipe

ASTM C 14 for pipe 24 inches or less in diameter. ASTM C 76 for pipe greater than 24 inches in diameter.

2.2.2 Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

2.2.2.1 PVC Pipe

ASTM D 3034 for type PSM pipe. ASTM F 949 for corrugated sewer pipe with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior.

2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions. Fittings and gaskets utilized for waste drains or industrial waste lines shall be certified by the manufacturer for the service indicated.

2.3.1 Concrete Pipe

Joints and gaskets shall conform to ASTM C 443.

2.3.2 Plastic Pipe

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or

shall conform to FS RR-F-621, type as suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 400 pounds. Reinforced concrete frames and covers shall be as indicated. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

2.6 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 12 feet. The ladder shall not be less than 16 inches in width, with 3/4 inch diameter rungs spaced 12 inches apart. The two stringers shall be a minimum 3/8 inch thick and 2 inch wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123.

2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking shall be used.

2.7.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 4000 psi at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 2500 psi minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

2.8 STRUCTURES

2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

2.8.2 Glass-Fiber Reinforced Polyester Manholes

Glass-fiber-reinforced polyester manholes shall conform to ASTM D 3753.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Adjacent Facilities

3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 10 feet to a water-supply main or service line, except that where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, the horizontal spacing may be a minimum of 6 feet. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 10 feet on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 3 feet to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 4 inches.

3.1.1.2 Roads and Airfields

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. Where sleeves are required, the pipe sleeve shall have a minimum clearance of at least 2 inches between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding shall be provided for the water pipe through the sleeve. Sleeves of ferrous material shall be provided with the corrosion protection as required for the conditions encountered at the site of installation.

3.1.1.3 Structures

Where sewer pipe is to be installed within 3 feet of an existing or proposed building or structural foundation such as a retaining wall, control tower footing, water tank footing, or any similar structure, the sewer pipe shall be sleeved as specified above. Care shall be exercised and proper precautions taken during installation of the sewer pipe and sleeve to assure that there will be no damage to such structures and no settlement or movement of foundations or footing.

3.1.2 Pipe Laying

a. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As

the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

c. Before making pipe joints all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

d. ABS composite pipe ends with exposed truss and filler material shall be coated with solvent weld material before making the joint to prevent water or air passage at the joint between the inner and outer wall of the pipe.

3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 1 inch after caulking.

1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02222 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install at no additional cost to the Government such concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

.1.2.5 Joints

Joints between different pipe materials shall be made as specified, using approved jointing materials.

.1.2.6 Handling and Storage

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 2 inches higher than finished grade in unpaved areas

3.5 CONNECTIONS TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made in such manner that the finish work will conform as nearly as practicable to the essential applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1-1/2 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

3.6 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 5 feet outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 5 feet from the site of the building at a point and in a manner designated.

3.7 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

3.8 SPECIAL PRECAUTIONS

Removal of wastewater lines composed of comentitous material (transite piping may contain asbestos. Special precautions should be taken during removal to minimize breakage of the piping, When cutting in required to remove such pipe, the pipe should be seated so as to decrease the potential release of fibers. Removal, transportation and disposal of such pipe shall be in accordance with all applicable TNRCC regulations. When removing Asbestos-Cement (AC) piping the contractor shall ensure that the following work practices are followed:

a. Cutting, abrading or breaking the AC piping, shall be prohibited unless the contractor can demonstrate that methods less likely to result in asbestos fiber release can not be used.

b. The contractor shall not exceed the Permissible Exposure Limit (PEL) to asbestos under any anticipated circumstances.

c. Each section of AC pipe shall be adequately wetted with amended water prior to and during its removal.

d. The AC pipe shall be removed in an intact state unless the contractor demonstrates that intact removal is not possible.

e. The AC pipe shall be placed on and double wrapped with 6-mil plastic sheeting.

SECTION 02733

CURED-IN PLACE LINER

1.0 DESCRIPTION

This item consists of the method and process for furnishing all labor, materials, tools, equipment, and incidentals necessary to provide for the complete rehabilitation of deteriorated sanitary sewer pipes, by forming a new tight fitting liner within the existing pipe. The installation of the cured-in-place liner shall be accomplished by the Inliner, Instuform or by an approved equal process. The process in a typical and general form consists of a flexible polyester felt fiber tube impregnated with an approved resin which is inserted into an existing pipe and cured with heat. The curing is accomplished by circulating heated water, to effect the desired cure throughout the length of the tube, extending full length from manhole to manhole(s). The resin should be cured into a hard impermeable pipe of the desired thickness, providing a structurally sound, uniformly smooth interior and tight fitting liner within the existing pipe. It shall provide a hydraulic flow equal to, or greater than, the original new sewer capacity.

2.0 SPECIFICATIONS AND TESTS:

This section references the ASTM Standards and Test Methods, which are being made part of the Specifications for the process to be used. ASTM Designation: F-1216-89, "Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin Impregnated Tube" shall be the general guide for the above mentioned acceptable alternate product/process. No change or alteration during the course of the contract shall be allowed without the prior written approval by the Contracting Officer. Physical properties of the approved resin components of the materials, as well as the cured liner, shall conform with the minimum structural values as listed below, unless changed or modified otherwise by the engineer.

2.1	Flexural Strength	4,500 p.s.i.	ASTM D-790
	Modulus of Elasticity	250,000 p.s.i. ASTM D-790	

2.2 Certified copies of all test reports on the properties of the selected resin, and later, on the cured liner coupons performed by, and/or for the contractor, shall be submitted to the Contracting Officer for approval prior to construction. Results of additional product testing(s), normally performed for "quality control" and process improvement, shall also be provided to the Contracting Officer, at no cost to the government. The contractor shall inform the Contracting Officer in writing, of the Name and Designation of all the quality control test(s) and the sampling frequency of the tests on the resin and liner materials. The Contracting Officer shall also have the right to require the testing to be done at designated liner location(s) within the scope of the contract at no cost to the government. Whenever possible and required, a short section of a sewer pipe very similar to the existing pipe, shall

be placed in the manhole to run the liner under restrained conditions, for later testing and thickness measurements, at no additional cost to the government. All samples shall be labeled before shipment for testing, inspection, and/or testing by an independent laboratory, as required by the contract and at no cost to the government. Flat plate samples and/or samples obtained or created outside field locations will not be accepted.

3.1 A Flexible Felt Fiber Tube:

The flexible polyester felt tube, shall be manufactured and fabricated under quality controlled conditions set by the process manufacturer, to a size that when installed, will snugly fit the internal circumference of the existing sewer and provide the required thickness when cured with the liquid thermosetting resin, as described later. The minimum length shall be as found necessary by the contractor, to effectively and fully span the actual field distance between the manholes, with extra allowance as needed for proper stretching/shrinkage due to pressure, expansion, and/or for lateral service cuttings, etc. However, payment shall be made for the actual field measurements between the centerlines of the manholes.

3.2 The Contracting Officer or his representatives shall have the right to modify/change the required liner thickness, depending upon field condition evident from the video tape. An analysis of design criteria and calculations for the liner thickness shall be provided to the Contracting Officer for approval, whose decisions shall be final. Liner thickness may vary for the same size sewer depending upon field condition of the pipes. and/or depths, Physical characteristics and properties of the felt tube shall also be submitted, if required by the engineer.

3.3 Videotaping:

3.3.1 The contractor shall furnish all labor, materials, equipment and incidentals to provide the televising and videotaping of sewer lines utilizing a color closed circuit television inspection unit to determine their condition.

3.3.2 Pipeline segments that are to be lined with a cured-in-place liner shall be televised after sewer flows have been bypassed and the conduit has been cleaned. After completion of the liner installation, the pipeline shall be televised prior to returning the main to service.

3.3.3 All new pipe shall be televised after installation.

3.3.4 The contractor shall provide a video tape and logs of the televised inspection to the engineer for review. If the contractor provides a videotape of such poor quality that it cannot be properly evaluated, the contractor shall retelevise as necessary and provide a tape of good quality at no additional cost to the government.

3.3.5 The TV unit shall also have the capability of displaying in color, on VHS video tape pipe inspection observations such as pipe defects. sags. points of root intrusion, offset

joints, service connection locations, etc. Each tape shall be permanently labeled with the project name, date of television inspection. location, size of conduit, street/easement location, name of contractor and tape number. The contractor shall provide a written log with each completed videotape describing the section being televised, flow and camera direction, position of service connections. description and locations of failures and other significant observations. These tapes shall become the property of the government.

3.3.6 The television inspection equipment shall have an accurate footage counter which displays on the monitor the exact distance of the camera from the center of the starting manhole. The camera height shall be centered in the conduit being televised. The speed of the camera through the conduit shall not exceed 25 feet per minute.

3.3.7 The contractor shall be required to have all materials, equipment and labor necessary to complete all videotaping on the job site prior to isolating the sewer manhole segment and beginning videotaping operations.

3.3.8 TV inspection shall be done one manhole section at a time, and the flow in the section being televised shall be bypassed. There shall be no flow in the pipeline at the time of televising.

3.3.9 The inspector will review the Pre-TV inspection in progress. Upon completion. the inspector will contact the Contracting Officer to further review the tape. if necessary. If the main is in suitable condition, the inspector will allow the liner to be inserted. The liner may be inserted only when approved by the Contracting Officer or his representative. It shall be the contractor's responsibility to contact the Contracting Officer/Representative to notify them of the times of TV inspection a minimum 24 hours in advance.

3.3.10 It is Possible that some sections of the sewer line cannot be televised. Therefore, house or building sewer connections will have to be located on the ground by the contractor.

3.3.11 There may be occasions during the TV inspection of a manhole section when the camera will be unable to pass an obstruction. At that time and prior to proceeding, the contractor shall televise the manhole section from the other direction in order to provide a suitable TV tape of the entire manhole section to the engineer. If more than 25% of the entire length of a sewer line cannot be televised because of obstructions, the Contracting Officer shall be immediately notified to determine if a point repair is necessary. If, in the opinion of the Contracting Officer or representative, a point repair is required, televising of the sewer line shall be continued upon successful completion of the point repair. No additional payment shall be made for additional set-ups required due to point repair.

3.3.12 The government makes no guarantee that all of the sanitary sewer main proposed to be TV inspected are clear for the passage of a camera. Provisions of paragraph 3.3.11 shall apply.

3.3.13 The method(s) used for securing passage of the camera are to be at the discretion of the contractor and approved by the inspector.

3.3.14 No separate and/or additional payment will be made for any excavation, man entry and/or any other method, which may will be required to retrieve video equipment(s) that have been hung up. destroyed, and/or lost during the operation.

3.3.15 No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item. All costs in connection with this item shall be included in the applicable contract price for this item of work.

3.4 The Cured-In-Place Liner thickness shall be calculated based on the following physical condition of the existing pipe.

3.4.1 All pipes shall be considered fully deteriorated.

3.4.2 All pipes shall be subject to full soil load of 120 lbs/cf., with applicable Live Load, and water table five feet below the top of the ground.

3.4.3 All pipes should be considered to have a minimum of 2% Ovality in the circumference.

3.4.4 Only condition (3.4.1) and (3.4.3) may be changed (after TV report), for later case by case design calculations, if required by the engineer. The engineer may also add, and/or modify the conditions, based on field information, and other considerations.

3.4.5 Based on above physical conditions the following shall be required liner thickness. using standard resin and the Design Criteria and Values mentioned earlier in these Specifications, (thickness shall be rounded to the next highest multiple of 1.5 mm after adding an allowance of 5B to the design thickness for resin migration.) Bidders and contractor shall also verify the table for correctness and must have any modifications approved by the government through an addendum before the bid date for information of all prospective bidders.

LINER THICKNESS

Sewer Diameter'	Pipe Invert Depth up to 8'	Pipe Invert 8' - 12'	Pipe Invert Over 12' - 20'
8"	.13 in	0.15 in	16 - .17 in

3.4.6 A similar table as above, for all liner thickness shall be required for any new proc if proposed. The contractor with the new process shall provide all design calculations, physical properties of the materials, with the stipulated physical conditions of the exis pipe. Smaller thickness may be allowed due to improved physical properties of the re

3.4.6 A similar table as above, for all liner thickness shall be required for any new process, if proposed. The contractor with the new process shall provide all design calculations, physical properties of the materials, with the stipulated physical conditions of the existing pipe. Smaller thickness may be allowed due to improved physical properties of the resin material; such as enhanced resin, liner tube materials and/or new process, if the calculations, formulas and method are fully elaborated with reference(s) and is submitted for approval well in advance prior to installation.

3.4.7 Resin:

The liquid thermosetting resin used to impregnate the polyester felt tube shall produce a properly cured tube that will be resistant to abrasion and corrosion due to solids, grit, sand, acids, and gases such as hydrogen sulfide, methane, and carbon monoxide. The resin selected shall have proven resistance to normal municipal sewage, especially sulfuric acid corrosion from hydrogen sulfide gas.

3.4.8 . The resin system to be used shall be manufactured by approved company(ies) selected by the "Cured-In-Place" process manufacturer. Relevant information from the resin manufacturer, shall include: specifications, characteristics and properties, as well as methods of application. This data shall be submitted to the Contracting Officer for approval. A written certification that the resin material complies with the required application, along with curing temperature, and duration of the temperature (step cooking temperatures/hours at each and final stages) depending upon the sever size and liner thickness, shall be supplied to the Contracting Officer. This information is necessary to be satisfied that the curing is being done according to some plan and procedure, and checked accordingly in the field during installation. The Contracting Officer shall also be informed in advance, for verification and inspection of the resin.

3.4.8.1 The Contracting Officer/representative shall also be informed in advance, for verification and inspection of the resin material at the "wet out" of the felt tube. The inspection shall be at the discretion of the Contracting Officer, which shall not relieve the contractor of his responsibilities. The inversion and heating schedule/plan shall be submitted at least 24 hours in advance. Heating shall continue uninterrupted until the desired temperature is achieved. Temperatures shall be measured at both ends by sensitive and accurate measuring devices, and the initials of the Contracting Officer or his representative shall be obtained. if he is present at the site.

3.4.8.2 Copies of curing temperature/time log sheets on approved format, shall be submitted to the Contracting Officer immediately after the curing is completed. It shall be imperative on the contractor to strictly follow the process manufacturer's criteria, guidelines and recommendations. A copy of the manufacturer's data shall be made available to the Contracting Officer and his representative. Any changes in guidelines will require the Contracting Officer's approval prior to implementing any changes.

3.5 CONSTRUCTION METHODS:

The following shall be the general procedure for installing a cured-in place liner within a segment of pipe:

a. Establish Bypass Pumping around pipe segment(s)
b. Clean pipe segment(s)
c. perform pre-inversion television inspection.
d. Perform point repair if necessary.
e. Install cured-in-place liner.
f. Reconnect services.
g. Perform post installation television inspection.
h. Restore segment(s) to service after approval from Contracting Officer and his representative.

This general procedure shall be followed unless and alternate procedure has been approved by the inspector.

3.5.1 PRE-INSTALLATION PREPARATIONS:

Prior to the commencing-it of the actual liner inversion process, the contractor will plan his work after review of previous television inspection tapes and reports (available for viewing at the engineer's place of business upon request). All point repairs must be satisfactorily completed, equipment and material mobilized, and the engineer shall be informed of the impending work schedules for liner installations.

3.5.1.1 Safety:

The contractor shall carry out his operations in strict accordance with all applicable OSHA Standards. Particular attention is drawn to those safety requirements involving work on an elevated platform and entry into a confined space. It shall be the contractor's responsibility to familiarize with OSHA Standards and Regulations pertaining to all aspects of the work.

3.5.1.2 Pre-Inversion Cleaning:
The existing conduit shall be cleaned prior to Television (TV) inspection. 3.5.1.3 Pre-inversion Television (TV) Inspection It shall be the responsibility of the contractor, to video (TV) inspect the sewer pipe immediately before the installation of the resin impregnated tube, to assure that the pipe is clean and pipe conditions have not changed.

3.5.1.4 By-Pass Pumping

3.5.1.4 By-Pass Pumping

The contractor shall provide for continuous sewage flow around the section or sections of pipe designated for the inversion process. The pump and bypass lines. shall have adequate capacity and size to handle the flow and will be subsidiary to this item.

3.5.2 INSTALLATION PROCEDURES: 3.5.2.1 Wet Out:

The contractor shall designate a location where the felt tube will be impregnated ("wet out") with resin using distribution rollers and vacuum, to thoroughly saturate the tube Prior to its dispatch for installation. The contractor shall inform the Contracting Officer in advance, to inspect the materials and the wet out procedure. A catalyst system or additive(s) compatible with the resin and tube, may be used as per the manufacturer's recommendation.

3.5.2.2 Insertion:

The resin impregnated tube shall be transported and kept in a refrigerated truck, until it is inserted through an existing manhole by means of an inversion or equal process, and the application of a water column sufficient to fully extend it to the next designated manhole or termination point. The inversion water column or steam pressure will be adjusted to sufficient height/pressure to cause the impregnated tube to invert from manhole to manhole, and hold the tube tight against the existing pipe wall. The inversion area/equipment shall be securely protected, and all damaged yards, driveways, walks, etc., shall be repaired at no cost to the government. Some processes may not use the inversion method for insertion of a liner.

3.5.2.3 Curing:

After the insertion is completed, the contractor shall use a suitable heat source and water or stream recirculation system, capable of delivering heat uniformly throughout the section, for a consistent cure of the resin. The contractor shall be aware of the conservation Practice utilized on base and express in Section 1000. The curing temperature shall be recommended by the resin/catalyst system or the process manufacturer. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing heat supply. Another such gauge shall be placed between the impregnated tube and the invert of the original pipe at the manhole(s) to monitor the outside liner temperatures during the resin curing process. Initial cure may be considered completed when the exposed portions of the felt tube pipe appear to be hard, and the remote sensing device indicates the temperatures to be adequate, as recommended by the resin/catalyst system manufacturer, and approved by the engineer. Curing temperatures and duration shall comply with submitted data and information.

3.5.2.4 Cool-Down:

column while draining hot water from a small hole at the opposite end of the cured-in-place pipe, so that a constant water column height is maintained until cool-down is completed. Care shall be taken in the release of the water column so that a vacuum will not develop, that could damage the newly installed pipe. Coupon samples shall be obtained for testing as stated earlier.

3.5.2.5 Finished Pipe:

The finished new cured-in-place-liner shall be continuous over the entire length of the inversion run, and be as free as commercially practicable from visual defects such as foreign inclusions, dry spots, pinholes and delamination. During the warranty period, which shall be defined as twelve calendar months after acceptance by the government, any defects which will affect the integrity or strength of the liner pipe or hydraulic capacity shall be repaired at the contractor's expense.

3.6 Though it may be licensed process; the contractor or the franchiser shall not change any material. design values or procedural matters stated or approved herein, without the Contracting Officer or his representative prior to knowledge and approval.

3.7 Damage to fences, repairs to yards, lawns, sidewalks, driveways, etc., due to movement of TV, cleaning, boiler, steam or other truck and/or erection of equipment shall be repaired and/or restored by the contractor at no additional expense to the government.

3.8 During the time when the existing pipe segment(s) is out of service to accommodate the installation of the cured-in-place liner, the contractor shall provide temporary sewer service to all residents. businesses and others connected to the existing main. This period shall extend from the time bypass pumping is established until the existing services within the segment are reconnected and the main is placed in service.

3.9 Temporary sewer service may be accomplished by providing holding facilities, bypass pumping or other methods or combination of methods and are all subject to approval by the inspector. The contractor shall be responsible for any damage to any property resulting from surcharge within a service lateral or main. The contractor shall locate existing clean outs on service lines and pump as necessary to prevent spillage and/or surcharge. There will be no separate pay item for providing temporary sewer service.

4.0 SEALING AT MANHOLES

The cured-in-place liner shall make a tight seal at the manhole opening with no annular gaps. Under all circumstances, 1 half inch diameter activated Oakum band soaked in Scotchseal 5600 or equal, shall be applied all around for an approved seal, unless approved otherwise. All large annular space shall be sealed by using activated Oakum soaked in Scotchseal 5600 or equal, and later covered with a cementitious mortar. This procedure shall be completed before proceeding to the next manhole section.

5.0 CURED-IN-PLACE LINER FAILURE

In the event the cured-in-place liner fails to meet the project specifications and is deemed unacceptable by the Contracting Officer or his representative, the pipe segment(s) shall be replaced by conventional open cut methods as directed by the Contracting Officer. If open cut replacement options are not available due to restrictions by the government, the contractor shall use methods of pipe replacement as directed by the Contracting Officer. The contractor shall be responsible for all costs, direct or indirect, associated with the replacement of the pipe segment, regardless of method, due to the failure of a cured-in-place liner to meet project specifications.

6.0 MEASUREMENT & PAYMENT:

The unit price bid for rehabilitating the sewer main in the manner described, shall be full compensation for all materials, labor, equipment, and incidentals required to insert the liner pipe within the sewer main, provide temporary sewer service, providing bypass pumping, providing pre and post installation television inspection and sealing the liner in the manholes/structures, reworking the manhole inverts and benches, etc. Payment will be for actual linear footage of liner installed in the field and shall be measured between the center lines of the manholes.

SECTION 02811

UNDERGROUND SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1785	(1991) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1989) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2287	(1992) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM D 2464	(1991) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	(1990a) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(1991a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	(1972; R 1983) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1990) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3261	(1990) Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM F 441	(1989) Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.26.1M	(1984) Water Hammer Arresters
ASME B1.2	(1983; R 1991; Errata May 1992) Gages and Gaging for Unified Inch Screw Threads
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C509	(1987) Resilient-Seated Gate Valves for Water and Sewerage Systems
AWWA C901	(1988; Errata 1988) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service

FEDERAL SPECIFICATION (FS)

FS WW-H-001220	(1994) Head, Sprinkler, (Underground Connected)
FS WW-S-610	(1994) Sprinkler, Lawn, (Surface Connected)

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCHR)

FCCHR-01	(1988) Manual of Cross-Connection Control

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1987) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(1985) Cast Iron Globe & Angle Valves Flanged and Threaded Ends

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(1988; Rev 1) Industrial Control Devices, Controllers and Assemblies
NEMA ICS 6	(1988; Rev 1) Enclosures for Industrial Control and Systems

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1993) National Electrical Code

1.2 PERFORMANCE REQUIREMENTS

System shall operate with a minimum water pressure of 55 psi at connection to main and 45 psi at the last head in each zone.

1.3 SUBMITTALS

Submittals shall be in accordance with the Contract Clauses portion of this contract.

1.4 DELIVERY AND STORAGE

All equipment delivered and placed in storage shall be protected from the weather; excessive humidity and temperature variation; direct sunlight (in the case of plastic or rubber materials); and dirt, dust, or other contaminants.

1.5 FIELD MEASUREMENTS

The Contractor shall verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

PART 2 PRODUCTS

2.1 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

2.1.1 Standard Products

Materials and equipment shall be the standard products of a manufacturer who has produced similar systems which have performed well for a minimum period of 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

2.1.2 Nameplates

Each item of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

2.1.3 Extra Stock

The following extra stock shall be provided: Two sprinkler heads of each size and type, two valve keys for operating manual valves, two wrenches for removing and installing each type of head, two quick coupler keys and hose swivels, and four irrigation controller housing keys.

2.2 PIPING MATERIALS

2.2 PIPING MATERIALS

2.2.1 Polyvinal Chloride (PVC) Pipe, Fittings and Solvent Cement

2.2.1.1 Pipe

Pipe shall conform to the requirements of ASTM D 1785, PVC 1120 Schedule 40

2.2.4.2 Fittings

Solvent welded socket type fittings shall conform to requirements of ASTM D 2466, Schedule 40. Threaded type fittings shall conform to requirements of ASTM D 2464, Schedule 80.

2.2.4.3 Solvent Cement

Solvent cement shall conform to the requirements of ASTM D 2564.

2.2.5 Dielectric Fittings

Fittings shall conform to ASTM F 441, Schedule 80, CPVC threaded pipe nipples, 4 inch minimum length.

2.2.6 Emitter Hose and Distribution Tubing

Emitter hose and distribution tubing shall conform to ASTM D 2287, maximum inside diameter of 1/2 inch, minimum wall thickness of 90 mils vinyl plastic extruded from non-rigid chloride, integrally algae-resistant, homogeneous throughout, smooth inside and outside, free from foreign materials, cracks, serration's, blisters and other effects. Slip fittings shall be provided.

2.3 SPRINKLER AND EMITTER HEADS

2.3.1 Pop-Up Spray Heads

Pop-up spray heads shall conform to the requirements of FS WW-01220, Type II, Class A,B,C,and D. Nozzle rises a minimum of 4 inches above body.

2.3.1.1 Shrubbery Sprinkler Heads

Sprinkler heads shall be conical spray with adjustable or non-adjustable coverage and designed for permanent aboveground mounting on riser or pop-ups at a height compatible with ground covers. Provide brass nozzles.

2.3.2 Rotary Pop-Up Sprinklers

Sprinklers shall be capable of the coverage and distribution rate, trajectory and maximum height of spray indicated. Construction shall be high impact molded plastic with filter screen, reducible

watering radius, and choice of nozzles and have adjustable radius capabilities.

2.3.3 Bubbler Sprinkler Heads

Heads shall be multiple-spray bubbler with adjustable flow and designed for permanent aboveground mounting on risers.

2.3.4 Surface Connected Lawn Sprinkler Heads

Heads shall conform to the requirements of FS WW-S-610.

2.3.5 Emitter Heads

Emitter heads shall be self-cleaning, pressure compensating diaphragm with one or six self-piercing barbed outlets; each capable of emitting from 1/4 to 2 gallons per hour flow. Emitter body shall be ultraviolet stabilized, algae, and heat resistant plastic construction.

2.4 VALVES

2.4.1 Gate Valves, Less than 3 Inches.

Gate valves shall conform to the requirements of MSS SP-80, Type 1, Class 150, threaded ends.

2.4.2 Gate Valves, 3 Inches and Larger

Gate valves shall conform to the requirements of AWWA C509 and have encapsulated resilient wedge, parallel seats, non-rising stems, and open by counterclockwise turning. End connections shall be flanged. Interior construction of valves shall be bronze including stem containing a maximum 2 percent aluminum and maximum 16 percent zinc.

2.4.3 Angle Valves, Less Than 65 mm (2-1/2 Inches)

Angle valves shall conform to the requirements of MSS SP-80, Type 3, Class 150 threaded ends.

2.4.4 Angle Valves, 2-1/2 Inches and Larger

Angle valves shall conform to the requirements of MSS SP-85, Type II, Class 250 threaded ends.

2.4.5 Quick Coupling Valves

Quick coupling valves shall have brass parts and shall be two-piece unit consisting of a coupler water seal valve assembly and a removable upper body to allow spring and key track to be serviced without shutdown of main. Lids shall be lockable vinyl with spring for positive closure on key removal.

2.4.6 Remote Control Valves, Electrical

Remote control valves shall be solenoid actuated globe valves of 3/4 to 3 inch size, suitable for 24 volts, 60 cycle, and designed to provide for shut-off in event of power failure. Valve shall be cast bronze or brass or plastic housing suitable for service at 150 psi operating pressure with external flow control adjustment for shut-off capability, external plug at diaphragm chamber to enable manual operation, filter in control chamber to prevent valve body clogging with debris, durable diaphragm, and accessibility to internal parts without removing valve from system.

2.4.7 Drain Valves

2.4.7.1 Manual Valves

Manual valves shall conform to requirements of MSS SP-80, Type 3, Class 150 threaded ends for sizes less than 2-1/2 inches and MSS SP-85, Type II, Class 250 threaded ends for sizes 2-1/2 inches and larger.

2.4.7.2 Automatic Valves

Automatic valves shall be brass or plastic, spring loaded ball drip type, Class 150 and threaded ends, designed to close at 6 foot pressure head with positive seal at 3 psi pressure or greater and be open to drain at less than 3 psi pressure.

2.4.8 Pressure Regulating Master Valve

Pressure regulating master valve shall be automatic mechanical self-cleaning, self-purging control system having an adjustable pressure setting operated by a solenoid on alternating current. Valve shall close slowly and be free of chatter in each diaphragm position, have manual flow stem to adjust closing speed and internal flushing, and one inlet tappings capable of being installed as a straight pattern valve. Body shall be cast bronze or brass with removable brass seat serviceable from top without removing valve body from system. Valve shall operate at 150 psi working pressure and pilot range from 10 to 125 psi.

2.4.9 Backflow Preventers

Double check valve assemblies shall be tested, approved, and listed in accordance with FCCHR-01.

2.5 ACCESSORIES AND APPURTENANCES

2.5.1 Valve Keys for Manually Operated Valves

Valve keys shall be 1/2 inch diameter by 3 feet long, tee handles and keyed to fit valves.

2.5.2 Valve Boxes and Concrete Pads

2.5.2.1 Valve Boxes

Valve boxes shall be cast iron, plastic lockable, or precast concrete for each gate valve, manual control valve and remote control valve. Box sizes shall be adjustable for valve used. Word "IRRIGATION" shall be cast on cover. Shaft diameter of box shall be minimum 5-1/4 inches. Cast iron box shall have bituminous coating.

2.5.2.2 Concrete Pads

Concrete pads shall be precast or cast-in-place reinforced concrete construction for reduced pressure type backflow preventers.

2.5.3 Pressure Gauges

Pressure gauges shall conform to requirements of ASME B40.1, single style pressure gauge for water with 4-1/2 inch dial brass or aluminum case, bronze tube, gauge cock, pressure snubber, and siphon. Scale range shall be suitable for irrigation sprinkler systems.

2.5.4 Service Clamps

Service clamps shall be bronze flat, double strap, with neoprene gasket or "O"-ring seal.

2.5.5 Water Hammer Arresters

Water hammer arrester shall conform to the requirements of ASME A112.26.1M; stainless steel construction with an encased and sealed bellows compression chamber.

2.5.6 Emitter Head Accessories

2.5.6.1 Strainer

Strainer shall be provided at inlet to each drip line. Strainer shall have stainless steel screen having equivalent of 140-mesh filtration capacity and incorporate flush valves within strainer to clean screen without disassembling unit.

2.5.6.2 Pressure Regulator

Pressure regulator shall be provided at each drip system if supply pressure exceeds 50 psi.

2.5.6.3 Riser Adapters

Riser adapters shall be provided with a rigid piping system.

2.5.6.4 Tubing Stakes

Tubing stakes shall be plastic coated steel, or other non-corrosive strong material to secure tubing.

2.5.6.5 Emitter Outlet Check Valve (Bug Cap)

Check valves shall be provided at end of each emitter outlet distribution line. Valves shall permit free flow of water with minimum restriction; prevent back siphoning, entry of insects, and contamination into outlet ports.

2.5.6.6 Access Sleeve

Access sleeve shall be provided at buried emitters placed in covered boxes. Lids of access sleeve shall be secured with removable lugs. Drip hose in both vertical and horizontal axis shall be secured.

2.5.6.7 Closure Caps

Closure caps shall be in accordance with manufacturer's recommendations.

2.6 AUTOMATIC CONTROLLERS, ELECTRICAL

Controller shall conform to the requirements of NEMA ICS 2 with 120-volt single phase service, operating with indicated stations, and grounded chassis. Enclosure shall conform to NEMA ICS 6 Type 3R, with locking hinged cover, pedestal-mounted. Controller shall be programmed for various schedules by setting switches and dials equipped with the following features: A switch for each day of week for indicated schedules, allowing each station to be scheduled individually as to days of watering; a minute switch for each station with a positive increment range as, set time within one percent; a switch allowing selected schedules to be repeated after each completion of initial watering schedule and allowing each operation to be scheduled throughout a 24-hour day; a circuit breaker for surge protection; and circuit for a 9-volt rechargeable NiCad battery.

2.7 ELECTRICAL WORK

Wiring and rigid conduit for electrical power shall be as specified and indicated on the drawings.

2.8 CONCRETE MATERIALS

Concrete shall have a compressive strength of 2500 psi at 28 days as specified.

2.9 WATER SUPPLY MAIN MATERIALS

3.1.3 Piping Installation

3.1.3.1 Polyvinyl Chloride (PVC) Pipe

a. Solvent-cemented joints shall conform to the requirements of ASTM D 2855.

b. Threaded joints shall be full cut with a maximum of three threads remaining exposed on pipe and nipples. Threaded joints shall be made tight without recourse to wicks or fillers, other than polytetrafluoroethylene thread tape.

c. Piping shall be joined to conform with requirements of ASTM D 2774 or ASTM D 2855, and pipe manufacturer's instructions. Pipe shall be installed in a serpentine (snaked) manner to allow for expansion and contraction in trench before backfilling. Pipes shall be installed at temperatures over 40 degrees F.

3.1.4 Valves

3.1.4.1 Manual Valves

Valves shall be installed in a valve box extending from grade to below valve body, with a minimum of 4 inches cover measured from finish grade to top of valve stem.

3.1.4.2 Automatic Valves

Valve shall be set plumb in a valve box extending from grade to below valve body, with minimum of 4 inch cover measured from grade to top of valve. Install automatic valves beside sprinkler heads with a valve box.

3.1.4.3 Drain Valves

Entire system shall be manually or automatically drainable. Low points of system shall be equipped with drain valve draining into an excavation containing 1 cubic foot gravel. Gravel shall be covered with building paper then backfilled with excavated material and 6 inches of topsoil.

3.1.5 Sprinklers and Quick Coupling Valves

Sprinklers and valves shall be installed plumb and level with terrain.

3.1.6 Backflow Preventers

Backflow preventer shall be installed in new connection to existing water distribution system, between connection and control valves. Backflow preventer shall be installed with concrete pads.

3.1.7 Control Wire and Conduit

3.1.7.1 Wires

Low voltage wires may be buried beside pipe in same trench. Rigid conduit shall be provided where wires run under paving. Wires shall be number tagged at key locations along main to facilitate service. One control circuit shall be provided for each zone and a circuit to control sprinkler system.

3.1.7.2 Loops

A 12 inch loop of wire shall be provided at each valve where controls are connected.

3.1.7.3 Expansion and Contraction

Multiple tubes or wires shall be bundled and taped together at 10 foot intervals with 12 inch loop for expansion and contraction.

3.1.7.4 Splices

Electrical splices shall be waterproof.

3.1.8 Automatic Controller

Exact field location of controllers shall be determined before installation. Coordinate the electrical service to these locations. Install in accordance with manufacturer's recommendations and NFPA 70.

3.1.9 Thrust Blocks

Concrete shall be placed so that sides subject to thrust or load are against undisturbed earth, and valves and fittings are serviceable after concrete has set. Thrust blocks shall be as specified in Section 02660, WATER LINES.

3.1.10 Backfill

3.1.10.1 Minimum Cover

Depth of cover shall be 18 inches unless otherwise specified on the drawings. Remainder of trench or pipe cover shall be filled to within 3 inches of top with excavated soil, and compact soil with plate hand-held compactors to same density as undisturbed adjacent soil.

3.1.10.2 Restoration

Top 3 inches shall be filled with topsoil and compacted with same density as surrounding soil. Lawns and plants shall be restored to match existing. Pavements shall be restored indicated.

3.1.11 Adjustment

After grading, seeding, and rolling of planted areas, sprinkler heads shall be adjusted flush with finished grade. Adjustments shall be made by providing new nipples of proper length or by use of heads having an approved device, integral with head, which will permit adjustment in height of head without changing piping.

3.1.12 Disinfection

Sprinkler system fed from a potable water system shall be disinfected upstream of backflow preventer in accordance with Section 02660, WATER LINES.

3.1.13 Cleaning of Piping

Prior to the hydrostatic and operation tests, the interior of the pipe shall be flushed with clean water until pipe is free of all foreign materials. Flushing and cleaning out of system pipe, valves, and components shall not be considered completed until witnessed and accepted by Contracting Officer.

3.2 FIELD TESTS

All instruments, equipment, facilities, and labor required to conduct the tests shall be provided by Contractor.

3.2.1 Hydrostatic Pressure Test

Piping shall be tested hydrostatically before backfilling and proved tight at a hydrostatic pressure of 150 psi without pumping for a period of one hour with an allowable pressure drop of 5 psi. If hydrostatic pressure cannot be held for a minimum of 4 hours, Contractor shall make adjustments or replacements and the tests repeated until satisfactory results are achieved and accepted by the Contracting Officer.

3.2.2 Operation Test

At conclusion of pressure test, sprinkler heads or emitter heads, quick coupling assemblies, and hose valves shall be installed and entire system tested for operation under normal operating pressure. Operation test consists of the system operating through at least one complete programmed cycle for all areas to be sprinkled.

3.3 POSTING FRAMED INSTRUCTIONS

Framed instructions containing wiring and control diagrams under glass or in laminated plastic shall be posted where directed. Condensed operating instructions, prepared in typed form, shall be framed as specified above and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the system. After as-built drawings are approved by Contracting Officer, controller charts and programming schedule shall be

prepared. One chart for each controller shall be supplied. Chart shall be a reduced drawing of actual as-built system that will fit the maximum dimensions inside controller housing. Black line print for chart and a different pastel or transparent color shall indicate each station area of coverage. After chart is completed and approved for final acceptance, chart shall be sealed between two 20 mil pieces of clear plastic.

3.4 FIELD TRAINING

A field training course shall be provided for designated operating and maintenance staff members. Training shall be provided for a total period of 3 hours of normal working time and shall start after the system is functionally complete but prior to final acceptance tests. Field training shall cover all of the items contained in the operating and maintenance manuals.

3.5 CLEANUP

Upon completion of installation of system, all debris and surplus materials resulting from the work shall be removed.

SECTION 03300

CONCRETE, GENERAL REQUIREMENTS

PART 1 - GENERAL

1. APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1 American Concrete Institute (ACI) Standards:

318-83	(R 1986)	Building Code Requirements for Reinforced Concrete.

1.2 American Society for Testing and Materials (ASTM) Standards:

C 31-91	Making and Curing Concrete Test Specimens in the Field
C 39-86	Compressive Strength of Cylindrical Concrete Specimens
C 94 Rev A-91	Ready-Mixed Concrete
C 143 Rev A-90	Slump of Portland Cement Concrete
C 150-89	Portland Cement
C 172-90	Sampling Freshly Mixed Concrete
C 173-78	Air Content of Freshly Mixed Concrete by the Volumetric Method
C 231 Rev B-91	Air Content of Freshly Mixed Concrete by the Pressure Method
C 309-91	Liquid Membrane-Forming Compounds for Curing Concrete
C 618-91	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
D 1751-83	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D 1752-84	Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

2. GENERAL REQUIREMENTS: Concrete and flowable fill shall be delivered in accordance with ASTM C 94, and the work shall be in conformance with ACI 318, part entitled "Construction Requirements", except as specified herein. The concrete plant may not be mobile, mounted on tires, capable of being propelled under its own power or licensed as a motor vehicle.

2.1 Compressive Strength:

2.1.1 Miscellaneous Concrete Structures: Concrete mixes shall be proportioned to obtain compressive strength in 28 days of 3,500 PSI.

2.1.2 Flowable Fill: Flowable fill mixes shall be proportioned to as indicated below.

2.2 Air Content: Total air content of exterior concrete shall be maintained at five to seven percent by volume of concrete.

2.3 Slump:

2.3.1 Concrete: Slump for concrete mixtures shall be maintained at two (2) inches plus or minus 1 inch for all concrete work unless variations are approved by the Contracting Officer, in writing for a specific job.

2.3.2 Flowable Fill: Slump or consistency for flowable fill shall be tested by filling an open-ended three inch diameter cylinder six inches high to the top with the flowable fill mixture. The cylinder shall be immediately pulled straight up and the correct consistency of the flowable fill shall produce a minimum eight inch diameter circular-type spread with no segregation of aggregate or separation of water.

3. SUBMITTALS:

3.1 Concrete Mix Design: The contractor shall submit for approval a concrete mix design showing the materials used in the concrete mix and their proportions. Slump, aggregate gradation, 7 day, and 28 day strengths shall be indicated. The concrete mix design need not be formulated for this specific job, and a mix design from a previous job is acceptable for submission. Admixtures may be used, as approved, to improve the properties of the mix.

3.2 Flowable Fill Mix Design: The contractor shall submit for approval a flowable fill mix design showing the materials used in the flowable fill mix and their proportions. Aggregate gradation and mixture proportions shall be as indicated shall be indicated. The flowable fill mix design need not be formulated for this specific job, and a mix design from a previous job is acceptable for submission. Admixtures may be used, as approved, to improve the properties of the mix. Should the contractor not have a mix design of proven performance, the following mix proportions are offered for use.

No. 1		No. 2	
Cement	100 lb	Cement	150 lb
Fly Ash	250 lb	Fly Ash	250 lb
Aggregate	2,800 lb	Aggregate	2,600 lb
Water	60 gal	Water	70 gal

No. 1 Flowable fill mixture shall be used against curb and gutter and other situations where traffic will not be placed within a 24 hour period. No. 2 flowable fill mixture shall be used in utility cuts and other areas subject to vehicle traffic within 24 hours after placement.

4. MEASUREMENT FOR PAYMENT:

4.1 Flowable Fill: Quantity of flowable fill to be paid for will be the number of cubic yards of flowable fill installed, regardless of mixture number, as directed by the Contracting Officer, and accepted in the completed work.

4.2 Flowable Fill Demolition: The quantity of flowable fill demolition to be paid for will be the number of cubic yards of flowable fill demolished, including removal and disposal, as directed by the Contracting Officer and accepted in the completed work. No differentiation will be made between reinforced or non-reinforced flowable fill.

4.3 Miscellaneous Concrete Structures: The quantity of miscellaneous concrete structures to be paid for will be the number of cubic yards of cast in place concrete installed in inlets, manholes, headwalls, endwalls, flared end sections, mitered end sections, walls, and for other general purposes, as directed by the Contracting Officer, accepted in the completed work. No reduction in concrete volume will be made for steel reinforcement items, however, voids required in the work will not be added to the quantity. Waste occurring during construction will not be included in the final volume computations. Excavation, backfill, or concrete used in the construction of concrete curb and gutter, concrete sidewalk, or concrete pavement will not be included in this measurement.

4.4 Miscellaneous Concrete Structure Demolition: The quantity of miscellaneous concrete structure demolition to be paid for will be the number of cubic yards of miscellaneous concrete structure demolished, including removal and disposal, as directed by the Contracting Officer and accepted in the completed work. No differentiation will be made between reinforced or non-reinforced concrete.

4.5 Reinforcing Steel: The quantity of reinforcing steel to be paid for will be the number of pounds of reinforcing steel installed in concrete curb and gutter, concrete sidewalk, concrete pavement and miscellaneous concrete structures as directed by the Contracting Officer, accepted in the completed work. Weight shall be determined by measuring the length of each size bar required and multiplying that length by the bar's nominal weight per foot. Fractional lengths will be included in the computation. However, waste occurring during construction will not be included in the final weight computations.

5. BASIS FOR PAYMENT:

5.1 Flowable Fill: Payment for the quantity of flowable fill, determined as specified above, will be made at the appropriate contract unit price per cubic yard as established in the bid schedule. Such payment shall constitute full compensation for all labor, materials, formwork, equipment, overhead, profit, supervision, and incidentals necessary to complete the work.

5.2 Flowable Fill Demolition: Payment for the quantity of flowable fill demolition, determined as specified above, will be made at the appropriate contract unit price per cubic yard as established in the bid schedule. Such payment shall constitute full compensation for all labor, equipment, transportation, disposal, overhead, profit , supervision, including demolition of reinforcing steel, and incidentals necessary to complete the work.

5.3 Miscellaneous Concrete Structures: Payment for the quantity of miscellaneous concrete structures, determined as specified above, will be made at the appropriate contract unit price per cubic yard as established in the bid schedule. Such payment shall constitute full compensation for all labor, materials, formwork, forming or creating joints, expansion joint filler, finishing, curing, testing, equipment, overhead, profit, supervision, and incidentals necessary to complete the work.

5.4 Miscellaneous Concrete Structure Demolition: Payment for the quantity of miscellaneous concrete structure demolition, determined as specified above, will be made at the appropriate contract unit price per cubic yard as established in the bid schedule. Such payment shall constitute full compensation for all labor, equipment, transportation, disposal, overhead, profit, supervision, including demolition of reinforcing steel, and incidentals necessary to complete the work.

5.5 Reinforcing Steel: Payment for the quantity of reinforcing steel, determined as specified above, will be made at the appropriate contract unit price per pound as established in the bid schedule. Such payment shall constitute full compensation for all labor, materials, equipment, overhead, profit, supervision, and incidentals necessary to complete the work.

6. WAYBILLS AND DELIVERY TICKETS: Waybills and delivery tickets required to be submitted for unit priced bid items where measurement for payment purposes is determined by weight or volume shall be signed by the Government Inspector at the time delivery is made and a copy of the waybill or delivery ticket given to the Goverment Inspector at that time. The waybill or delivery ticket will remain the possession of the Government Inspector and this will constitute submission. The contractor shall retain a copy of the waybill or delivery ticket for his records. Unsigned waybills and delivery tickets will not be considered for payment and the contractor shall coordinate delivery of materials requiring waybills and delivery tickets with Contract Section to ensure a Government Inspector will be present at the time delivery is made. Before the final payment is allowed, waybills and certified delivery tickets shall be furnished for all concrete, flowable fill and reinforcing steel actually used in the construction.

PART 2 - PRODUCTS

7. CONCRETE shall consist of a mixture of the following materials in combination with water to produce a mixture with the desired properties:

7.1 Concrete Materials:

7.1.1 Concrete Aggregate: Aggregate mixture shall be composed of fine and coarse crushed aggregates combined to form a well-graded aggregate mix with the maximum nominal aggregate size being 1 inch. Aggregates shall be free from injurious amounts of salt, alkali, vegetable matter or other objectionable material.

7.1.2 Concrete Cement: Cement Type I in accordance with ASTM C 150. Only one brand of any one type of cement shall be used for exposed concrete surfaces of any individual structure.

8. FLOWABLE FILL shall consist of a mixture of the following materials in combination with water to produce a mixture with the desired properties:

8.1 Flowable Fill Materials:

8.1.1 Flowable Fill Aggregate: Aggregate mixture shall be composed of natural or manufactured sand or a combination thereof, free from injurious amounts of salt, alkali, vegetable matter or other objectionable material. The aggregate shall be fine enough to stay in suspension in the cement mortar to the extent required for proper flow. The aggregate gradation shall conform to the following:

Sieve Size	% Passing
3/4 inch	100

No. 200	0 - 10

8.1.2 Flowable Fill Cement: Cement Type I in accordance with ASTM C 150.

8.1.3 Fly Ash: Fly ash shall be either Class C or Class F meeting the requirements of ASTM C 618.

9. WATER: Water used in the formulation of concrete and flowable fill mixtures shall be free of foreign materials, organic matter, acids, etc. and shall meet the requirements set forth in ASTM C 94.

10. ACCESSORIES:

10.1 Curing Materials: Curing materials shall be of the membrane-forming variety and shall conform to ASTM C 309, Type 2. Curing compounds shall be sprayable, nontoxic, and of the type that will dry within four hours and form a film highly resistant to moisture loss from concrete while curing. Compound shall be clear with NO fugitive dye.

10.2 Expansion Joint Filler Strips: Expansion joint filler strips for curb and gutter and other purposes shall be premolded nonextruding, resilient bituminous or nonbituminous type for use in concrete construction, 1/2-inch thick, and shall comply with ASTM D 1751 or ASTM D 1752. Expansion joint filler strips shall be cut to the cross section of the curb and gutter and sidewalk.

10.3 Contraction Joint Filler Strips: Contraction joint filler strips for curb and gutter and other purposes shall consist of hard-pressed fiberboard or steel sheet of approximately 1/8 inch thickness cut to the cross section of the curb and gutter or other structure.

10.4 Form Coating: Nonstaining form oil or form release agent that will not adversely affect concrete surfaces nor impair subsequent applications.

10.5 Form Ties and Other Forming Accessories: Accessories shall be the standard products of a manufacturer engaged concrete forming accessory manufacture, and shall be provided as required.

10.6 Form Board: Form board shall be smooth and of sufficient thickness to withstand the weight of the intended structure during the concrete curing time.

10.7 Cast Iron Frames and Covers: Cast iron frame and cover shall be Model No. R-6144 as manufactured by Neenah Foundry Company, Ph. (414) 725-7000, or approved equal.

10.8 Cast Iron Frames and Grates: Cast iron frame and grate shall be Model No. R-3430 as manufactured by Neenah Foundry Company, Ph. (414) 725-7000, or approved equal.

11. STEEL REINFORCEMENT:

11.1 Dowels: Smooth carbon steel bars, equipped with caps on one end, minimum yield point of 40,000 PSI for use in construction of curb and gutter expansion joints, miscellaneous structures, concrete pavement and for other purposes as required.

11.2 Reinforcement Bars: Deformed, Grade 40 or Grade 60 billet steel for use in miscellaneous structures, curb and gutter, concrete pavement and for other purposes as required.

PART 3 - EXECUTION

12. WEATHER LIMITATIONS:

12.1 Placing During Cold Weather: Concrete and flowable fill placement shall be discontinued when the air temperature reaches 40 degrees F and is falling. Placement may begin when the air temperature reaches 35 degrees F and is rising. Provisions shall be made to protect the concrete and flowable fill from freezing during the specified curing period. If necessary to place concrete or flowable fill when the temperature of the air, aggregates, or water is below 35 degrees F, placement shall be approved in writing. Approval shall be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the material is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place material being between 50 and 85 degrees F. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the materials at a temperature of at least 50 degrees F for not less than 72 hours for concrete and 12 hours for flowable fill after placing, and at a temperature above freezing for the remainder of the curing period.

12.2 Placing During Warm Weather: The temperature of the concrete as placed shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing

temperature. In no case shall the placing temperature exceed 95 degrees F. There are no restrictions on warm weather placing of flowable fill.

13. FORM WORK, GENERAL: Form work for construction of general concrete structures such as curb inlets and headwalls shall be made mortar tight, properly aligned and adequately supported to produce concrete structures conforming accurately to the indicated shapes, lines, dimensions, and with surfaces free of offset, waviness, or bulges. Where surfaces are to be exposed, panels shall be manufacturer's stock size material, using smaller panels cut to required dimensions only where required by openings and joints. Panel joints in exposed work shall occur at corner joints, including alignment with control joints and construction joints. Unless otherwise shown, exposed external corners shall be chamfered, beveled, or rounded by moldings placed in the forms. Surfaces shall be thoroughly cleaned and coated before each use. Forms shall be removed at a time and in a manner that will not injure the concrete. Form work for placing flowable fill will generally be limited to that required to hold flowable fill in utility trenches, etc. and prevent flowable fill from flowing out of excavations being filled.

14. REINFORCEMENT shall be fabricated to the shapes required. Laps shall be at least twelve full bar diameters; staggered to avoid continuous lap in any one direction; and securely wired or welded in place. Bars shall be sized as shown herein and shall be placed in accordance with ACI 318. Dowels at curb and gutter and concrete pavement expansion joints shall be installed at right angles to joints; accurately aligned parallel to the finished surface and rigidly held in place and supported during concrete placement. One end of dowels shall be equipped with caps and be oiled or greased.

15. PLACING CONCRETE; GENERAL: Concrete shall be placed upon clean undisturbed surfaces free from frost, ice, and water. Surfaces receiving concrete shall be wetted with water just prior to concrete placement.

16. CONSOLIDATION OF CONCRETE: Except for concrete curb and gutter, each layer of concrete shall be consolidated with internal concrete vibrators supplemented by hand spading, rodding, and tamping. Vibrating equipment shall be adequate to thoroughly consolidate the concrete. Curb and gutter/valley gutter concrete shall be consolidated by hand.

17. FINISHING CONCRETE; GENERAL:

17.1 Formed Surfaces: Fins and loose material shall be removed. Unsound concrete, voids over 1/2-inch in diameter, and tie-rod and bolt holes shall be cut back to solid concrete, reamed, brush-coated with cement grout, and filled solid with a stiff Portland-cement-sand mortar mix. Patchwork shall be finished flush with adjoining concrete surfaces and, where exposed, shall match adjoining surfaces in texture and color. Patchwork shall be cured for 72 hours. White Portland cement shall be used as needed to attain color match, if required.

17.2 Unformed Surfaces: Surfaces shall be finished to a true plane with no deviation exceeding 5/16 inch when tested with a ten-foot straightedge. Surfaces shall be pitched to drains. Surfaces shall be screeded and floated to the required finish level with no coarse aggregate visible before finishing as specified below.

18. CURING AND PROTECTION OF CONCRETE:

18.1 General Requirements: Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking due to temperature changes during the curing period.

18.1.1 Membrane Curing Method: A uniform coating of membrane-curing compound free from any fugitive dye shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied when the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified

curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

19. PLACEMENT OF FLOWABLE FILL: Flowable fill shall be used as directed, but is generally intended for use as backfill for utility cuts, repairs to soft areas in base/subgrade, between new curb and gutter and pavement to remain and other locations where a controlled density material may be required. The contractor shall place flowable fill only when and at the locations specified or approved by the Government. Flowable fill requires minimal finishing, and no curing, but shall be placed accurately in the desired section by the use of forms, earthen berms, etc. as approved to check and control the flow of the material. Surface to receive asphalt shall be trowelled reasonably smooth to prevent waviness in the finished asphalt surface. Care shall be taken to prevent flowable fill from entering any sanitary sewer, storm sewer, or other utility lines encountered in the work.

20. FIELD QUALITY CONTROL:

20.1 General Requirements: The contractor shall perform the inspection and tests described herein and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

20.2 Concrete Testing:

20.2.1 Strength Testing: The contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken and tested. Testing requires four cylinders for two strength tests at 28 days age for each mix design, each days placement and each 20 cubic yards thereafter. Two cylinders held in reserve. Strength tests shall be performed in accordance with ASTM C 39. The samples for strength tests shall be taken in accordance with ASTM C 172. Unless otherwise approved, cylinders for acceptance shall be molded in conformance with ASTM C 31 by an approved testing laboratory. Each strength test result shall be the average of two test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the average of the two cylinder strength test results equal or exceed the specified strength, and no individual cylinder strength test result falls below the specified strength by more than 500 PSI.

20.2.2 Air Content: Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars with relatively dense natural aggregates. Air content tests shall be made at the frequency of one each, for each mix design, each days placement and each 20 cubic yards thereafter. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

20.2.3 Slump Test: Slump tests shall be made in accordance with ASTM C 143 at the frequency of one each, for each mix design, each days placement and each 20 cubic yards thereafter. Additional tests will be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noticed along the edges of slip-formed concrete.

20.3 Flowable Fill Testing: Testing of flowable fill to determine consistency and degree of separation, using the apparatus described in subparagraph Slump, shall be accomplished when directed. Results of such tests shall be used to adjust the mix proportions to achieve better properties, at no additional cost to the Government.

21. REMOVAL AND REPLACEMENT OF DEFECTIVE CONCRETE: Defective or damaged concrete shall be removed and replaced as specified herein and in SECTION: CONCRETE SIDEWALKS AND CURBS AND GUTTERS, and in SECTION: PATCHING OF RIGID PAVEMENT, and the method of curing specified shall be employed. All removed concrete shall be replaced with concrete of the thickness and quality required by these specifications. In no case shall the removal and replacement of concrete result in a slab less than the full sidewalk or curb and gutter width or a joint less than 5 feet from a regularly scheduled transverse joint. The defective concrete shall be removed carefully so that the adjacent section is not damaged. When a portion of an unfractured slab is replaced, a full depth saw cut shall be made transversely across the slab in the required location and the concrete shall be removed to provide a vertical face in the remaining portion of the slab. Prior to placement of the fresh concrete, the face of the slab shall be cleaned of debris and loose concrete. Transverse joints of the replaced slab or portion thereof shall be constructed as indicated. Removal and replacement of defective or damaged concrete shall be accomplished by the contractor at no additional cost to the Government.

End Of Section

SECTION 16640

CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 418	(1988) Cast and Wrought Galvanic Zinc Anodes

NATIONAL ASSOCIATION OF CORROSION ENGINEERS (NACE)

NACE RP0169	(1992) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA TC 2	(1990) Electrical Polyvinyl Chloride (PVC) Tubing&\ (EPT) and Conduit (EPC-40 and EPC-80)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1993) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 6	(1981; Rev thru Dec, 1992) Rigid Metal Conduit
UL 510	(1986; Rev Oct 1986) Insulating Tape
UL 514A	(1991) Metallic Outlet Boxes

1.2 GENERAL REQUIREMENTS

1.2.1 Services of Corrosion Engineer

The Contractor shall obtain the services of a corrosion engineer to supervise and to inspect the installation of the cathodic protection system. Corrosion Engineer refers to a person, who, by reason of his knowledge of the physical sciences and the principles of engineering and mathematics, acquired by professional education and related practical experience, is qualified to engage in the practice of corrosion control on buried or submerged metallic piping systems and metallic tanks. Such person may be a licensed

professional engineer or may be a person certified as being qualified by the National Association of Corrosion Engineers if such licensing or certification includes suitable experience in corrosion control on buried or submerged metallic piping systems and metallic tanks. The corrosion engineer shall insure that the cathodic protection system is installed, tested, and placed into service in accordance with the requirements specified.

1.2.2 Rules

The installation shall conform to the applicable rules of NFPA 70.

1.3 SUBMITTALS

Submittals shall be in accordance with the Contract Clauses portion of this project.

PART 2 PRODUCTS

2.1 ANODES

2.1.1 Magnesium Anodes

Magnesium anodes shall be as indicated.

2.1.2 Connecting Wire

Wire shall be No. 12 AWG solid copper wire, not less than 10 feet long, unspliced, complying with NFPA 70, Type TW or RHH insulation. Connecting wires for magnesium anodes shall be factory installed with the place of emergence from the anode in a cavity sealed flush with a dielectric sealing compound.

2.1.3 Artificial Backfill

Anodes shall be factory packaged with an artificial backfill as indicated.

2.2 MISCELLANEOUS MATERIALS

2.2.1 Electrical Wire

Wire shall as indicated. Connecting wire splicing shall be copper compression connections made for the purpose or exothermic welds following instructions of the manufacturer. Split-bolt connections shall not be used.

2.2.2 Conduit

Rigid galvanized steel conduit and accessories shall conform to UL 6. Non metallic conduit shall conform to NEMA TC 2.

2.2.3 Test Boxes and Junctions Boxes

Boxes shall be outdoor type conforming to UL 514A.

2.2.4 Joint, Patch, Seal, and Repair Coating

Sealing and dielectric compound shall be a black, rubber based compound that is soft, permanently pliable, tacky, moldable, and unbacked. Compound shall be applied as recommended by the manufacturer, but not less than 1/2-inch thick. Pressure-sensitive vinyl plastic electrical tape shall conform to UL 510.

2.2.5 Preformed Sheaths

Sheaths for encapsulating electrical wire splices to be buried underground shall fit the insulated wires entering the spliced joint.

2.2.6 Epoxy Potting Compound

Compound for encapsulating electrical wire splices to be buried underground shall be a two package system made for the purpose.

2.2.7 Test Stations

Test stations shall be complete with an insulated terminal block having the indicated number of terminals and shall be provided with a lockable cover and have a cast-in legend, "C.P. Test".

PART 3 EXECUTION

3.1 INSTALLATION

Unless otherwise indicated, all equipment shall be installed in accordance with the manufacturer's recommendations.

3.1.1 Anode Installation

Anodes of the size indicated shall be installed at the locations shown. Locations may be changed to clear obstructions if approved. Anodes shall be installed as indicated in a dry condition after any plastic or waterproof protective covering has been completely removed from the water permeable, permanent container housing the anode metal. The anode connecting wire shall not be used for lowering the anode into the hole. The annular space around the anode shall be backfilled with fine earth in 6-inch layers and each layer shall be hand tamped. Care must be exercised not to strike the anode or connecting wire with the tamper. Approximately 5 gallons of water shall be applied to each filled hole after anode backfilling and tamping has been completed to a point about 6 inches above the anode. After the water has been absorbed by the earth, backfilling shall be completed to the ground surface level.

Single anodes spaced as shown shall be connected as shown allowing adequate slack in the connecting wire to compensate for movement during backfill operation. Groups of anodes in quantity and

Single anodes spaced as shown shall be connected as shown allowing adequate slack in the connecting wire to compensate for movement during backfill operation. Groups of anodes in quantity and location shown shall be connected to a collector cable. The collector cable shall make contact with the structure to be protected only through a test station. Resistance wires shall not be used to reduce the current output of individual or group anodes. Connections to ferrous pipe shall be made by exothermic weld methods manufactured for the type of pipe. Electric arc welded connections and other types of welded connections to ferrous pipe and structures shall be approved before use.

3.1.2 Test Stations

Test stations shall be of the type and location shown. Buried electrically insulating joints shall be provided with test wire connections brought to a test station

3.2 CRITERIA OF PROTECTION

Criteria for determining the adequacy of protection on a buried pipe shall be in accordance with NACE RP0169 and shall be selected by the corrosion engineer as applicable.

3.2.1 Iron and Steel

One of the following methods shall apply:

3.2.1.1 850 MV Negative Voltage

A negative voltage of at least minus 0.85 volt as measured between the pipe and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe. Determination of this voltage shall be made with the cathodic system in operation.

3.2.1.2 300 MV Negative Voltage

A negative voltage shift of at least 300 millivolts as measured between the pipe and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe. Determination of this voltage shift shall be made with the protective current applied. These criteria apply to pipes not in electrical contact with dissimilar metals.

3.2.1.3 100 MV Polarization Voltage

A minimum polarization voltage shift of 100 millivolts as measured between the pipe and a saturated copper-copper sulfate reference electrode contacting the earth directly over the pipe. This polarization voltage shift shall be determined by interrupting the protective current and measuring the polarization decay. When the protective current is interrupted, an immediate voltage shift will occur. The voltage reading, after the immediate shift, shall be used as the base reading from which to measure polarization decay.

3.3.1 Baseline Potentials

After backfill of the pipe and anodes is completed, but before the anodes are connected to the pipe, the static potential-to-soil of the pipe shall be measured. The locations of these measurements shall be identical to the locations specified for pipe to-reference electrode potential measurements. The initial measurements shall be recorded.

3.3.2 Insulation Testing

Before the anode system is connected to the pipe an insulation test shall be made at each insulating joint or fitting. This test shall demonstrate that no metallic contact, or short circuit exists between the two insulated sections of the pipe. Any insulating fittings installed and found to be defective shall be reported to the Contracting Officer.

3.3.3 Anode Output

As the anodes or groups of anodes are connected to the pipe, current output shall be measured with an approved low resistance ammeter. The values obtained and the date, time, and location shall be recorded.

3.3.4 Pipe To-Reference Electrode Potential Measurements

Upon completion of the installation and with the entire cathodic protection system in operation, electrode potential measurements shall be made using a copper-copper sulfate reference electrode and a potentiometer-voltmeter, or a direct current voltmeter having an internal resistance (sensitivity) of not less than 100,000 ohms per volt and a full scale of 1 or 2 volts. The locations of these measurements shall be identical to the locations used for the baseline potentials. The values obtained and the date, time, and locations of measurements shall be recorded.

3.3.5 Location of Measurements

3.3.5.1 Piping or Conduit

For coated piping or conduit, measurements shall be taken from the reference electrode located in contact with the earth, directly over the pipe. Connection to the pipe shall be made at service risers, valves, test leads, or by other means suitable for test purposes. Measurements shall be made at intervals not exceeding 400 feet. In no case shall less than three measurements be made over any length of line. Additional measurements shall be made at each distribution service riser, with the reference electrode placed directly over the service line.

3.3.6 Casing Tests

Casing tests before final acceptance of the installation, the electrical separation of carrier pipe from casings shall be tested and any short circuits corrected.

3.3.7 Interference Testing

Before final acceptance of the installation, interference tests shall be made with respect to any foreign pipes in cooperation with the owner of the foreign pipes. A full report of the tests giving all details shall be made.

3.3.8 Recording Measurements

All pipe to-soil potential measurements including initial potentials where required shall be recorded. The Contractor shall locate, correct and report to the Contracting Officer any short circuits to foreign pipes encountered during checkout of the installed cathodic protection system. Pipe to-soil potential measurements are required on as many pipes as necessary to determine the extent of protection or to locate short-circuits.

3.4 PIPE JOINTS

3.4.1 Electrical Continuity

Underground pipe shall be electrically continuous except at places where electrically insulating joints are specified. Pipe joined by means other than welding shall meet electrical continuity requirements. The following mechanical joints that are not factory designed to provide electrical continuity shall be bonded by installing a metallic bond across the joint. The bonding connections shall be made by the exothermic welding process. Mechanical joints designed to provide electrical continuity shall meet manufacturer's published standards.

3.4.2 Coating

Mechanical joints and fittings of either the electrically conductive or insulating type shall be coated with an underground type dielectric coating system. Where external electrical continuity bonds are installed across mechanical joints, all bare or exposed metal, welds, bare wire and exposed coupling parts shall be coated with a coating system. Couplings and fittings which have a low profile exterior designed to permit tape coating shall be primed and wrapped with an underground type pipe tape following recommendations of the coupling or fitting manufacturer. Couplings and fittings that cannot be properly taped shall be enclosed in a spaced mold manufactured for the purpose or a shroud of reinforced kraft paper and filled with polyurethane foam having a cellular structure that will not absorb water, cold applied dielectric compound or hot applied bituminous compound not exceeding 275 degrees F in application temperature.

3.5 ELECTRICAL ISOLATION OF STRUCTURES

3.5.1 Insulating Fittings

Insulating flanges and couplings shall be installed aboveground, or within manholes, wherever possible, but an insulating device that electrically separates a pipeline shall not be installed in a confined area where a combustible atmosphere may collect unless precautions are taken to prevent arcing such as by means of externally located lightning arresters, grounding cells, or other means. Insulating flanges and couplings in lines entering buildings shall be located at least 12 inches above grade or floor level. Pipelines entering buildings either below or above ground shall be electrically isolated from the structure wall with an electrically isolating gas tight wall sleeve.

3.5.2 Gas Distribution Piping

Electrical isolation shall be provided at each building riser pipe to the pressure regulator, at all points where a short circuit to another structure or to a foreign structure may occur, and at other locations as indicated.

3.5.3 Copper Piping

Copper piping shall be wrapped with pipeline tape and electrically isolated at both ends.

3.6 DISSIMILAR METALS

3.6.1 Underground Dissimilar Piping

Buried piping of dissimilar metals including new and old steel piping, excepting valves, shall be electrically separated by means of electrically insulating joints at every place of connection. The insulating joint, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of 10 diameters on each side of the joint.

3.6.2 Underground Dissimilar Valves

Dissimilar ferrous valves in a buried ferrous pipeline, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of 10 diameters on each side of the valve. Brass or bronze valves shall not be used in a buried ferrous pipeline.

3.6.3 Aboveground Dissimilar Pipe and Valves

If the dissimilar metal pipe junction, including valves, is not buried and exposed to atmosphere only, the connection or valve, including the pipe, shall be coated with an underground type dielectric coating for a minimum distance of three diameters on each side of the junction.

dielectric coating for a minimum distance of three diameters on each side of the junction.

3.7 CASING

Where a pipeline is installed in a casing under a roadway or railway, the pipeline shall be electrically insulated from the casing and annular space sealed against incursion of water.

	MECHANICAL UTILITY SYSTEMS ID/IQ				
	PROPOSED SCHEDULE - BASIC				
ITEM	DESCRIPTION	EST QTY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	UNIT PRICE INCLUDES ALL COSTS INCLUDING MATERIAL				
	IDQ WATER/IRRIGATION LINE QUANTITIES				
1	**10" PVC WATER LINE**	2200	LF	$	$
2	10" Ell (45 or 90)	3	EA	$	$
3	10" Tee w/reducer, incrs.	15	EA	$	$
4	10" Cross	2	EA	$	$
5	10" Gate Valve	5	EA	$	$
6	10" Tie to Exist Main	2	EA	$	$
7	10" Hot Tap inc. Valve	1	EA	$	$
8	10" Repair Coupling	3	EA	$	$
9	**8" PVC WATER LINE**	1000	LF	$	$
10	8" Ell (45 OR 90)	8	EA	$	$
11	8"Tee w/reducer, incrs.	8	EA	$	$
12	8" Cross	1	EA	$	$
13	8" Gate Valve	3	EA	$	$
14	8" Tie to Exist Main	5	EA	$	$
15	8" Hot Tap inc. Valve	3	EA	$	$
16	8" Repair Coupling	4	EA	$	$
17	**6" PVC WATER LINE**	500	LF	$	$
18	6" Ell (45 or 90)	5	EA	$	$
19	6" Tee w/reducer, incrs.	5	EA	$	$
20	6" Cross	1	EA	$	$
21	6" Gate Valve	5	EA	$	$
22	6" Tie to Exist Main	4	EA	$	$
23	6" Hot tap inc. valve	4	EA	$	$
24	6" Repair Coupling	3	EA	$	$
25	**4" PVC WATER LINE**	500	LF	$	$
26	4" Ell (45 or 90)	5	EA	$	$

27	4" Tee w/reducer, incrs.	5	EA	$	$
28	4" Cross	3	EA	$	$
29	4" Gate Valve	4	EA	$	$
30	4" Hot Tap Inc. Valve	3	EA	$	$
31	4" Repair Coupling	3	EA	$	$
32	4" Tie to Exist Main	2	EA	$	$
33	4" Check Valve	2	EA	$	$
34	**3" PVC WATER LINE**	800	LF	$	$
35	3" Ell (45 or 90)	60	EA	$	$
36	3" Tee w/reducer, incrs.	15	EA	$	$
37	3" Gate Valve	15	EA	$	$
38	3" Hot Tap inc. Valve	5	EA	$	$
39	3" Compression Coupling	7	EA	$	$
40	3" Check Valve	4	EA	$	$
41	**2 1/2" PVC WATER LINE**	750	LF	$	$
42	2 1/2" Ell (45 or 90)	60	EA	$	$
43	2 1/2" Tee w/reducer, incrs.	30	EA	$	$
44	2 1/2" Cross	5	EA	$	$
45	2 1/2" Gate Valve	12	EA	$	$
46	2 1/2" Tie to Exist Main	7	EA	$	$
47	2 1/2" Hot Tap inc Valve	5	EA	$	$
48	2 1/2" Repair Coupling	5	EA	$	$
49	**2" PVC WATER LINE**	2000	LF	$	$
50	2" Ells (45 or 90)	45	EA	$	$
51	2" Tee w/reducer, incrs.	25	EA	$	$
52	2" Tie to Exist Main	12	EA	$	$
53	2" Gate Valve	40	EA	$	$
54	**1 1/2" PVC WATER LINE**	2800	LF	$	$
55	1 1/2" Ell (45 or 90)	85	EA	$	$
56	1 1/2" Tee w/reducer, incrs.	20	EA	$	$
57	1 1/2" Tie to Exist Main	7	EA	$	$
58	1 1/2" Gate Valve	35	EA	$	$
59	**1 " PVC WATER LINE**	2000	LF	$	$
60	1" Ell (45 or 90)	50	EA	$	$
61	1" Tee w/reducer, incrs.	15	EA	$	$
62	1" Tie to Exist Main	3	EA	$	$
63	1" Gate Valve	10	EA	$	$

64	**1/2" PVC WATER LINE**	2000	LF	$ _____	$ _____
65	1/2" Ell (45 or 90)	75	EA	$ _____	$ _____
66	1/2" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
67	1/2" Gate Valve	20	EA	$ _____	$ _____
68	Repair Cut Sprinkler System	20	EA	$ _____	$ _____
69	Fire Hydrant Assembly	20	EA	$ _____	$ _____
70	Meter Boxes	11	EA	$ _____	$ _____
71	Potable Water Tests	10	EA	$ _____	$ _____
72	Thrust Blocks	100	CY	$ _____	$ _____
73	Valve Boxes	25	EA	$ _____	$ _____
	SANITARY SEWER QUANTITIES				
74	**12" PVC SANITARY SEWER**	100	LF	$ _____	$ _____
75	10" PVC SANITARY SEWER	200	LF	$ _____	$ _____
76	8" PVC SANITARY SEWER	300	LF	$ _____	$ _____
77	6" PVC SANITARY SEWER	400	LF	$ _____	$ _____
78	4" PVC SANITARY SEWER	500	LF	$ _____	$ _____
79	3" PVC SANITARY SEWER	700	LF	$ _____	$ _____
80	Clean lines (3" thru 12")	5000	LF	$ _____	$ _____
	MANHOLE REHABILITATION				
81	Height Adjustment	5	EA	$ _____	$ _____
82	Replace Cover	4	EA	$ _____	$ _____
83	Concrete Ring & Cover	4	EA	$ _____	$ _____
84	Seal Ring & Cover	32	EA	$ _____	$ _____
85	Seal Walls	80	VLF	$ _____	$ _____
86	Reconstruction	30	VLF	$ _____	$ _____
87	Reconstruct Base	5	EA	$ _____	$ _____
88	New Manholes 5' I.D., 4" Deep	3	EA	$ _____	$ _____
89	New Manholes 5' I.D., 6' Deep	7	EA	$ _____	$ _____
90	New Manholes 5' I.D., 8' Deep	21	EA	$ _____	$ _____
91	Greater than 8' (add)	75	VLF	$ _____	$ _____
92	Remove Existing M.H. & Catch Basen	20	EA	$ _____	$ _____
93	Abandon Fill or Grout	100	VLF	$ _____	$ _____
94	Drop Manhole Connection	10	EA	$ _____	$ _____

95	Sanitary Sewer Connection	31	EA	$ _____	$ _____
96	Lateral Repairs	40	LF	$ _____	$ _____
97	Pipe Lining 8", 0' - 299'	100	LF	$ _____	$ _____
98	Pipe Lining 8", 300' - 600'	200	LF	$ _____	$ _____
99	Pipe > Than 600'	300	LF	$ _____	$ _____
100	Reconnection of Services	10	EA	$ _____	$ _____
	IDQ GAS LINE QUANTITIES				
101	10" Hot Tap Including Valve	3	EA	$ _____	$ _____
102	**8" POLYETHYLENE GAS LINE**	1550	LF	$ _____	$ _____
103	8" Ell (45 or 90)	10	EA	$ _____	$ _____
104	8" Tee w/reducer, Incrs,	10	EA	$ _____	$ _____
105	8" Cross	2	EA	$ _____	$ _____
106	8" Gate Valve	4	EA	$ _____	$ _____
107	8" Tie to Exist Main	3	EA	$ _____	$ _____
108	8" Hot Tap inc. valve	3	EA	$ _____	$ _____
109	**6" POLYETHYLENE GAS LINE**	4700	LF	$ _____	$ _____
110	6" Ell (45 or 90)	10	EA	$ _____	$ _____
111	6" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
112	6" Cross	2	EA	$ _____	$ _____
113	6" Gate Valve	5	EA	$ _____	$ _____
114	6" Tie to Exist Main	3	EA	$ _____	$ _____
115	6" Hot Tap inc. Valve	3	EA	$ _____	$ _____
116	**4" POLYETHYLENE GAS LINE**	3370	LF	$ _____	$ _____
117	4" Ell 945 or 90)	10	EA	$ _____	$ _____
118	4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
119	4" Cross	2	EA	$ _____	$ _____
120	4" Gate Valve	10	EA	$ _____	$ _____
121	4" Tie to Exist Main	5	EA	$ _____	$ _____
122	4" Hot Tap inc. Valve	3	EA	$ _____	$ _____
123	4" Service Tie to New Main	3	EA	$ _____	$ _____
124	4" Check Valve	2	EA	$ _____	$ _____
125	**3" POLYETHYLENE GAS LINE**	5449	LF	$ _____	$ _____
126	3" Ell (45 or 90)	10	EA	$ _____	$ _____
127	3" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
128	3" Gate Valve	5	EA	$ _____	$ _____

129	3" Hot Tap inc. Valve	3	EA	$ _____	$ _____
130	3" Compression Coupling	10	EA	$ _____	$ _____
131	3" Check Valve	2	EA	$ _____	$ _____
132	**2" POLYETHYLENE GAS LINE**	1000	LF	$ _____	$ _____
133	2" Ell (45 or 90)	15	EA	$ _____	$ _____
134	2" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
135	2" Tie to Exist Main	5	EA	$ _____	$ _____
136	2" Gate Valve	10	EA	$ _____	$ _____
137	**1 1/4" POLYETHYLENE GAS LINE**	350	LF	$ _____	$ _____
138	1 1/4" Ell (45 or 90)	10	EA	$ _____	$ _____
139	1 1/4" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
140	1 1/4" Tie to Exist Main	10	EA	$ _____	$ _____
141	1 1/4" Gate Valve	20	EA	$ _____	$ _____
142	**1" POLYETHYLENE GAS LINE**	300	LF	$ _____	$ _____
143	1" Ell (45 or 90)	5	EA	$ _____	$ _____
144	1" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
145	1" Tie to Exist Main	5	EA	$ _____	$ _____
146	1" Gate Valve	10	EA	$ _____	$ _____
147	**3/4" POLYETHYLENE GAS LINE**	500	LF	$ _____	$ _____
148	3/4" Ell (45 or 90)	10	EA	$ _____	$ _____
149	3/4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
150	3/4" Tie to Exist Main	5	EA	$ _____	$ _____
151	3/4" Gate Valve	5	EA	$ _____	$ _____
152	2" Gas Stop w/wo Check	10	EA	$ _____	$ _____
153	1 1/2" Gas Stop w/wo Check	10	EA	$ _____	$ _____
154	1 1/4" Gas Stop w/wo Check	10	EA	$ _____	$ _____
155	1" Gas Stop w/wo check	10	EA	$ _____	$ _____
156	Gas Meter Box	10	EA	$ _____	$ _____
157	Valve Box	10	EA	$ _____	$ _____
158	3" Double Check Valve	3	EA	$ _____	$ _____
159	2 1/2" Double Check Valve	4	EA	$ _____	$ _____
160	2" Double Check Valve	5	EA	$ _____	$ _____
161	1 1/2" Double Check Valve	5	EA	$ _____	$ _____
162	1" Double Check Valve	5	EA	$ _____	$ _____
163	1/2" Double Check Valve.	5	EA	$ _____	$ _____
164	Pop-up Head & Nozzle	200	EA	$ _____	$ _____
	low/med volume, PVC				

165	Shrub Spray Head	20	EA	$ _____	$ _____
166	Curb Box	100	EA	$ _____	$ _____
167	Controller: 12 Station	25	EA	$ _____	$ _____
168	Controller: 8 Station	25	EA	$ _____	$ _____
169	Control Wire	6000	LF	$ _____	$ _____
170	Testing & Disinfecting	2	EA	$ _____	$ _____
	IDQ EXCAVATION AND BACKFILL QUANTITIES				
	Utility Trench Excavation **in dirt**				
	Excavate 6" WIDE Trench				
171	@ 12" Deep	12000	LF	$ _____	$ _____
172	@ 18" Deep	2500	LF	$ _____	$ _____
173	@ 24" Deep	2500	LF	$ _____	$ _____
174	@ 36" Deep	2500	LF	$ _____	$ _____
175	@ 48" Deep	3500	LF	$ _____	$ _____
176	@ 60" Deep	4000	LF	$ _____	$ _____
	Backfill 6" WIDE Trench				
177	@ 12" Deep	3500	LF	$ _____	$ _____
178	@ 18" Deep	2500	LF	$ _____	$ _____
179	@ 24" Deep	2500	LF	$ _____	$ _____
180	@ 36" Deep	2500	LF	$ _____	$ _____
181	@ 48" Deep	3500	LF	$ _____	$ _____
182	@ 60" Deep	4000	LF	$ _____	$ _____
183	Exca/Backfill Backhoe 1-4' Deep	2000	CY	$ _____	$ _____
184	" " " 4-6' Deep	2000	CY	$ _____	$ _____
185	" " " 6-10' Deep	3700	CY	$ _____	$ _____
186	" " " 10-14' Deep	3703	CY	$ _____	$ _____
187	" " " 14-16' Deep	3333	CY	$ _____	$ _____
188	Hand Excavate/Backfill	100	CY	$ _____	$ _____
189	Rock Excavation/Backfill	50	CY	$ _____	$ _____
190	Jack/bore 6" Casing/Pipe	500	LF	$ _____	$ _____
191	" " 8" Casing/Pipe	500	LF	$ _____	$ _____

192	" " 10" Casing/Pipe	500	LF	$ _____	$ _____
193	" " 12" Casing/Pipe	500	LF	$ _____	$ _____
194	" " 16" Casing/Pipe	500	LF	$ _____	$ _____
195	Remove Asph Pvmt and Drwy	500	SY	$ _____	$ _____
196	Replace Asph Pvmt and Drwy	500	SY	$ _____	$ _____
197	Remove Conc Pvmt	500	SY	$ _____	$ _____
198	Replace Conc Pvmt	500	SY	$ _____	$ _____
199	Sidewalk Concrete Broom Finish	300	SY	$ _____	$ _____
200	Remove Conc Curb	300	LF	$ _____	$ _____
201	Replace Conc Curb	300	LF	$ _____	$ _____
202	Remove Sidewalk/Driveway	300	SY	$ _____	$ _____
203	Crushed Aggregate Base Course	300	CY	$ _____	$ _____
204	Remove & Repl Flowable Fill	200	CY	$ _____	$ _____
205	Reinforced Steel	800	LB	$ _____	$ _____
206	Sodding 1" Deep	3760	SY	$ _____	$ _____
207	Seeding Bluegrass	1850	SF	$ _____	$ _____
208	Hydromulching	145	MSF	$ _____	$ _____
	IDQ MISCELLANEOUS ITEMS QUANTITIES				
209	Wellpoint Pump Operation	2	EA	$ _____	$ _____
210	Pneumatic Plug	15	EA	$ _____	$ _____
211	By-pass Pumping	15	EA	$ _____	$ _____
212	Water for Cleaning	5000	GAL	$ _____	$ _____
213	Disposal of Wastewater	5000	GAL	$ _____	$ _____
214	Rodding of Sewer	50	HR	$ _____	$ _____
215	Removal Asbestos Pipe	60	LF	$ _____	$ _____
216	Transition Fittings (Poly to Steel)	15	EA	$ _____	$ _____
217	Insert Stiffeners	50	EA	$ _____	$ _____
218	Pipe Wrap, Tape/Primer	2500	LF	$ _____	$ _____
219	Bedding Sand	293	CY	$ _____	$ _____
220	Anodeless Service Riser	30	EA	$ _____	$ _____
221	Regulators	30	EA	$ _____	$ _____
222	Marking Tape	9	ROLL	$ _____	$ _____
223	Soil Density Testing	10	HR	$ _____	$ _____
224	Demo Utility Lines	1500	LF	$ _____	$ _____
225	Per Diem/Man/Day	240	DY	$ _____	$ _____

	MECHANICAL UTILITY SYSTEMS ID/IQ				
	PROPOSED SCHEDULE - OPTION YEAR ONE				
ITEM	DESCRIPTION	EST QTY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	UNIT PRICE INCLUDES ALL COSTS INCLUDING MATERIAL				
	IDQ WATER/IRRIGATION LINE QUANTITIES				
1	**10" PVC WATER LINE**	2200	LF	$ _____	$ _____
2	10" Ell (45 or 90)	3	EA	$ _____	$ _____
3	10" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
4	10" Cross	2	EA	$ _____	$ _____
5	10" Gate Valve	5	EA	$ _____	$ _____
6	10" Tie to Exist Main	2	EA	$ _____	$ _____
7	10" Hot Tap inc. Valve	1	EA	$ _____	$ _____
8	10" Repair Coupling	3	EA	$ _____	$ _____
9	**8" PVC WATER LINE**	1000	LF	$ _____	$ _____
10	8" Ell (45 OR 90)	8	EA	$ _____	$ _____
11	8"Tee w/reducer, incrs.	8	EA	$ _____	$ _____
12	8" Cross	1	EA	$ _____	$ _____
13	8" Gate Valve	3	EA	$ _____	$ _____
14	8" Tie to Exist Main	5	EA	$ _____	$ _____
15	8" Hot Tap inc. Valve	3	EA	$ _____	$ _____
16	8" Repair Coupling	4	EA	$ _____	$ _____
17	**6" PVC WATER LINE**	500	LF	$ _____	$ _____
18	6" Ell (45 or 90)	5	EA	$ _____	$ _____
19	6" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
20	6" Cross	1	EA	$ _____	$ _____
21	6" Gate Valve	5	EA	$ _____	$ _____
22	6" Tie to Exist Main	4	EA	$ _____	$ _____
23	6" Hot tap inc. valve	4	EA	$ _____	$ _____
24	6" Repair Coupling	3	EA	$ _____	$ _____
25	**4" PVC WATER LINE**	500	LF	$ _____	$ _____
26	4" Ell (45 or 90)	5	EA	$ _____	$ _____

64	**1/2" PVC WATER LINE**	2000	LF	$ _____	$ _____
65	1/2" Ell (45 or 90)	75	EA	$ _____	$ _____
66	1/2" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
67	1/2" Gate Valve	20	EA	$ _____	$ _____
68	Repair Cut Sprinkler System	20	EA	$ _____	$ _____
69	Fire Hydrant Assembly	20	EA	$ _____	$ _____
70	Meter Boxes	11	EA	$ _____	$ _____
71	Potable Water Tests	10	EA	$ _____	$ _____
72	Thrust Blocks	100	CY	$ _____	$ _____
73	Valve Boxes	25	EA	$ _____	$ _____
	SANITARY SEWER QUANTITIES				
74	**12" PVC SANITARY SEWER**	100	LF	$ _____	$ _____
75	10" PVC SANITARY SEWER	200	LF	$ _____	$ _____
76	8" PVC SANITARY SEWER	300	LF	$ _____	$ _____
77	6" PVC SANITARY SEWER	400	LF	$ _____	$ _____
78	4" PVC SANITARY SEWER	500	LF	$ _____	$ _____
79	3" PVC SANITARY SEWER	700	LF	$ _____	$ _____
80	Clean lines (3" thru 12")	5000	LF	$ _____	$ _____
	MANHOLE REHABILITATION				
81	Height Adjustment	5	EA	$ _____	$ _____
82	Replace Cover	4	EA	$ _____	$ _____
83	Concrete Ring & Cover	4	EA	$ _____	$ _____
84	Seal Ring & Cover	32	EA	$ _____	$ _____
85	Seal Walls	80	VLF	$ _____	$ _____
86	Reconstruction	30	VLF	$ _____	$ _____
87	Reconstruct Base	5	EA	$ _____	$ _____
88	New Manholes 5' I.D., 4" Deep	3	EA	$ _____	$ _____
89	New Manholes 5' I.D., 6' Deep	7	EA	$ _____	$ _____
90	New Manholes 5' I.D., 8' Deep	21	EA	$ _____	$ _____
91	Greater than 8' (add)	75	VLF	$ _____	$ _____
92	Remove Existing M.H. & Catch Basen	20	EA	$ _____	$ _____
93	Abandon Fill or Grout	100	VLF	$ _____	$ _____
94	Drop Manhole Connection	10	EA	$ _____	$ _____

95	Sanitary Sewer Connection	31	EA	$ _____	$ _____
96	Lateral Repairs	40	LF	$ _____	$ _____
97	Pipe Lining 8", 0' - 299'	100	LF	$ _____	$ _____
98	Pipe Lining 8", 300' - 600'	200	LF	$ _____	$ _____
99	Pipe > Than 600'	300	LF	$ _____	$ _____
100	Reconnection of Services	10	EA	$ _____	$ _____
	IDQ GAS LINE QUANTITIES				
101	10" Hot Tap Including Valve	3	EA	$ _____	$ _____
102	**8" POLYETHYLENE GAS LINE**	1550	LF	$ _____	$ _____
103	8" Ell (45 or 90)	10	EA	$ _____	$ _____
104	8" Tee w/reducer, Incrs,	10	EA	$ _____	$ _____
105	8" Cross	2	EA	$ _____	$ _____
106	8" Gate Valve	4	EA	$ _____	$ _____
107	8" Tie to Exist Main	3	EA	$ _____	$ _____
108	8" Hot Tap inc. valve	3	EA	$ _____	$ _____
109	**6" POLYETHYLENE GAS LINE**	4700	LF	$ _____	$ _____
110	6" Ell (45 or 90)	10	EA	$ _____	$ _____
111	6" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
112	6" Cross	2	EA	$ _____	$ _____
113	6" Gate Valve	5	EA	$ _____	$ _____
114	6" Tie to Exist Main	3	EA	$ _____	$ _____
115	6" Hot Tap inc. Valve	3	EA	$ _____	$ _____
116	**4" POLYETHYLENE GAS LINE**	3370	LF	$ _____	$ _____
117	4" Ell 945 or 90)	10	EA	$ _____	$ _____
118	4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
119	4" Cross	2	EA	$ _____	$ _____
120	4" Gate Valve	10	EA	$ _____	$ _____
121	4" Tie to Exist Main	5	EA	$ _____	$ _____
122	4" Hot Tap inc. Valve	3	EA	$ _____	$ _____
123	4" Service Tie to New Main	3	EA	$ _____	$ _____
124	4" Check Valve	2	EA	$ _____	$ _____
125	**3" POLYETHYLENE GAS LINE**	5449	LF	$ _____	$ _____
126	3" Ell (45 or 90)	10	EA	$ _____	$ _____
127	3" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
128	3" Gate Valve	5	EA	$ _____	$ _____

192	" " 10" Casing/Pipe	500	LF	$ _____	$ _____
193	" " 12" Casing/Pipe	500	LF	$ _____	$ _____
194	" " 16" Casing/Pipe	500	LF	$ _____	$ _____
195	Remove Asph Pvmt and Drwy	500	SY	$ _____	$ _____
196	Replace Asph Pvmt and Drwy	500	SY	$ _____	$ _____
197	Remove Conc Pvmt	500	SY	$ _____	$ _____
198	Replace Conc Pvmt	500	SY	$ _____	$ _____
199	Sidewalk Concrete Broom Finish	300	SY	$ _____	$ _____
200	Remove Conc Curb	300	LF	$ _____	$ _____
201	Replace Conc Curb	300	LF	$ _____	$ _____
202	Remove Sidewalk/Driveway	300	SY	$ _____	$ _____
203	Crushed Aggregate Base Course	300	CY	$ _____	$ _____
204	Remove & Repl Flowable Fill	200	CY	$ _____	$ _____
205	Reinforced Steel	800	LB	$ _____	$ _____
206	Sodding 1" Deep	3760	SY	$ _____	$ _____
207	Seeding Bluegrass	1850	SF	$ _____	$ _____
208	Hydromulching	145	MSF	$ _____	$ _____
	IDQ MISCELLANEOUS ITEMS QUANTITIES				
209	Wellpoint Pump Operation	2	EA	$ _____	$ _____
210	Pneumatic Plug	15	EA	$ _____	$ _____
211	By-pass Pumping	15	EA	$ _____	$ _____
212	Water for Cleaning	5000	GAL	$ _____	$ _____
213	Disposal of Wastewater	5000	GAL	$ _____	$ _____
214	Rodding of Sewer	50	HR	$ _____	$ _____
215	Removal Asbestos Pipe	60	LF	$ _____	$ _____
216	Transition Fittings (Poly to Steel)	15	EA	$ _____	$ _____
217	Insert Stiffeners	50	EA	$ _____	$ _____
218	Pipe Wrap, Tape/Primer	2500	LF	$ _____	$ _____
219	Bedding Sand	293	CY	$ _____	$ _____
220	Anodeless Service Riser	30	EA	$ _____	$ _____
221	Regulators	30	EA	$ _____	$ _____
222	Marking Tape	9	ROLL	$ _____	$ _____
223	Soil Density Testing	10	HR	$ _____	$ _____
224	Demo Utility Lines	1500	LF	$ _____	$ _____
225	Per Diem/Man/Day	240	DY	$ _____	$ _____

MECHANICAL UTILITY SYSTEMS ID/IQ

PROPOSED SCHEDULE - OPTION YEAR TWO

ITEM	DESCRIPTION	EST QTY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	UNIT PRICE INCLUDES ALL COSTS INCLUDING MATERIAL				
	IDQ WATER/IRRIGATION LINE QUANTITIES				
1	**10" PVC WATER LINE**	2200	LF	$	$
2	10" Ell (45 or 90)	3	EA	$	$
3	10" Tee w/reducer, incrs.	15	EA	$	$
4	10" Cross	2	EA	$	$
5	10" Gate Valve	5	EA	$	$
6	10" Tie to Exist Main	2	EA	$	$
7	10" Hot Tap inc. Valve	1	EA	$	$
8	10" Repair Coupling	3	EA	$	$
9	**8" PVC WATER LINE**	1000	LF	$	$
10	8" Ell (45 OR 90)	8	EA	$	$
11	8"Tee w/reducer, incrs.	8	EA	$	$
12	8" Cross	1	EA	$	$
13	8" Gate Valve	3	EA	$	$
14	8" Tie to Exist Main	5	EA	$	$
15	8" Hot Tap inc. Valve	3	EA	$	$
16	8" Repair Coupling	4	EA	$	$
17	**6" PVC WATER LINE**	500	LF	$	$
18	6" Ell (45 or 90)	5	EA	$	$
19	6" Tee w/reducer, incrs.	5	EA	$	$
20	6" Cross	1	EA	$	$
21	6" Gate Valve	5	EA	$	$
22	6" Tie to Exist Main	4	EA	$	$
23	6" Hot tap inc. valve	4	EA	$	$
24	6" Repair Coupling	3	EA	$	$
25	**4" PVC WATER LINE**	500	LF	$	$
26	4" Ell (45 or 90)	5	EA	$	$

27	4" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
28	4" Cross	3	EA	$ _____	$ _____
29	4" Gate Valve	4	EA	$ _____	$ _____
30	4" Hot Tap Inc. Valve	3	EA	$ _____	$ _____
31	4" Repair Coupling	3	EA	$ _____	$ _____
32	4" Tie to Exist Main	2	EA	$ _____	$ _____
33	4" Check Valve	2	EA	$ _____	$ _____
34	**3" PVC WATER LINE**	800	LF	$ _____	$ _____
35	3" Ell (45 or 90)	60	EA	$ _____	$ _____
36	3" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
37	3" Gate Valve	15	EA	$ _____	$ _____
38	3" Hot Tap inc. Valve	5	EA	$ _____	$ _____
39	3" Compression Coupling	7	EA	$ _____	$ _____
40	3" Check Valve	4	EA	$ _____	$ _____
41	**2 1/2" PVC WATER LINE**	750	LF	$ _____	$ _____
42	2 1/2" Ell (45 or 90)	60	EA	$ _____	$ _____
43	2 1/2" Tee w/reducer, incrs.	30	EA	$ _____	$ _____
44	2 1/2" Cross	5	EA	$ _____	$ _____
45	2 1/2" Gate Valve	12	EA	$ _____	$ _____
46	2 1/2" Tie to Exist Main	7	EA	$ _____	$ _____
47	2 1/2" Hot Tap inc Valve	5	EA	$ _____	$ _____
48	2 1/2" Repair Coupling	5	EA	$ _____	$ _____
49	**2" PVC WATER LINE**	2000	LF	$ _____	$ _____
50	2" Ells (45 or 90)	45	EA	$ _____	$ _____
51	2" Tee w/reducer, incrs.	25	EA	$ _____	$ _____
52	2" Tie to Exist Main	12	EA	$ _____	$ _____
53	2" Gate Valve	40	EA	$ _____	$ _____
54	**1 1/2" PVC WATER LINE**	2800	LF	$ _____	$ _____
55	1 1/2" Ell (45 or 90)	85	EA	$ _____	$ _____
56	1 1/2" Tee w/reducer, incrs.	20	EA	$ _____	$ _____
57	1 1/2" Tie to Exist Main	7	EA	$ _____	$ _____
58	1 1/2" Gate Valve	35	EA	$ _____	$ _____
59	**1 " PVC WATER LINE**	2000	LF	$ _____	$ _____
60	1" Ell (45 or 90)	50	EA	$ _____	$ _____
61	1" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
62	1" Tie to Exist Main	3	EA	$ _____	$ _____
63	1" Gate Valve	10	EA	$ _____	$ _____

64	**1/2" PVC WATER LINE**	2000	LF	$ _____	$ _____
65	1/2" Ell (45 or 90)	75	EA	$ _____	$ _____
66	1/2" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
67	1/2" Gate Valve	20	EA	$ _____	$ _____
68	Repair Cut Sprinkler System	20	EA	$ _____	$ _____
69	Fire Hydrant Assembly	20	EA	$ _____	$ _____
70	Meter Boxes	11	EA	$ _____	$ _____
71	Potable Water Tests	10	EA	$ _____	$ _____
72	Thrust Blocks	100	CY	$ _____	$ _____
73	Valve Boxes	25	EA	$ _____	$ _____
	SANITARY SEWER QUANTITIES				
74	**12" PVC SANITARY SEWER**	100	LF	$ _____	$ _____
75	10" PVC SANITARY SEWER	200	LF	$ _____	$ _____
76	8" PVC SANITARY SEWER	300	LF	$ _____	$ _____
77	6" PVC SANITARY SEWER	400	LF	$ _____	$ _____
78	4" PVC SANITARY SEWER	500	LF	$ _____	$ _____
79	3" PVC SANITARY SEWER	700	LF	$ _____	$ _____
80	Clean lines (3" thru 12")	5000	LF	$ _____	$ _____
	MANHOLE REHABILITATION				
81	Height Adjustment	5	EA	$ _____	$ _____
82	Replace Cover	4	EA	$ _____	$ _____
83	Concrete Ring & Cover	4	EA	$ _____	$ _____
84	Seal Ring & Cover	32	EA	$ _____	$ _____
85	Seal Walls	80	VLF	$ _____	$ _____
86	Reconstruction	30	VLF	$ _____	$ _____
87	Reconstruct Base	5	EA	$ _____	$ _____
88	New Manholes 5' I.D., 4" Deep	3	EA	$ _____	$ _____
89	New Manholes 5' I.D., 6' Deep	7	EA	$ _____	$ _____
90	New Manholes 5' I.D., 8' Deep	21	EA	$ _____	$ _____
91	Greater than 8' (add)	75	VLF	$ _____	$ _____
92	Remove Existing M.H. & Catch Basen	20	EA	$ _____	$ _____
93	Abandon Fill or Grout	100	VLF	$ _____	$ _____
94	Drop Manhole Connection	10	EA	$ _____	$ _____

95	Sanitary Sewer Connection	31	EA	$ _____	$ _____
96	Lateral Repairs	40	LF	$ _____	$ _____
97	Pipe Lining 8", 0' - 299'	100	LF	$ _____	$ _____
98	Pipe Lining 8", 300' - 600'	200	LF	$ _____	$ _____
99	Pipe > Than 600'	300	LF	$ _____	$ _____
100	Reconnection of Services	10	EA	$ _____	$ _____
	IDQ GAS LINE QUANTITIES				
101	10" Hot Tap Including Valve	3	EA	$ _____	$ _____
102	**8" POLYETHYLENE GAS LINE**	1550	LF	$ _____	$ _____
103	8" Ell (45 or 90)	10	EA	$ _____	$ _____
104	8" Tee w/reducer, Incrs,	10	EA	$ _____	$ _____
105	8" Cross	2	EA	$ _____	$ _____
106	8" Gate Valve	4	EA	$ _____	$ _____
107	8" Tie to Exist Main	3	EA	$ _____	$ _____
108	8" Hot Tap inc. valve	3	EA	$ _____	$ _____
109	**6" POLYETHYLENE GAS LINE**	4700	LF	$ _____	$ _____
110	6" Ell (45 or 90)	10	EA	$ _____	$ _____
111	6" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
112	6" Cross	2	EA	$ _____	$ _____
113	6" Gate Valve	5	EA	$ _____	$ _____
114	6" Tie to Exist Main	3	EA	$ _____	$ _____
115	6" Hot Tap inc. Valve	3	EA	$ _____	$ _____
116	**4" POLYETHYLENE GAS LINE**	3370	LF	$ _____	$ _____
117	4" Ell 945 or 90)	10	EA	$ _____	$ _____
118	4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
119	4" Cross	2	EA	$ _____	$ _____
120	4" Gate Valve	10	EA	$ _____	$ _____
121	4" Tie to Exist Main	5	EA	$ _____	$ _____
122	4" Hot Tap inc. Valve	3	EA	$ _____	$ _____
123	4" Service Tie to New Main	3	EA	$ _____	$ _____
124	4" Check Valve	2	EA	$ _____	$ _____
125	**3" POLYETHYLENE GAS LINE**	5449	LF	$ _____	$ _____
126	3" Ell (45 or 90)	10	EA	$ _____	$ _____
127	3" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
128	3" Gate Valve	5	EA	$ _____	$ _____

129	3" Hot Tap inc. Valve	3	EA	$	$
130	3" Compression Coupling	10	EA	$	$
131	3" Check Valve	2	EA	$	$
132	**2" POLYETHYLENE GAS LINE**	1000	LF	$	$
133	2" Ell (B17645 or 90)	15	EA	$	$
134	2" Tee w/reducer, incrs.	5	EA	$	$
135	2" Tie to Exist Main	5	EA	$	$
136	2" Gate Valve	10	EA	$	$
137	**1 1/4" POLYETHYLENE GAS LINE**	350	LF	$	$
138	1 1/4" Ell (45 or 90)	10	EA	$	$
139	1 1/4" Tee w/reducer, incrs.	5	EA	$	$
140	1 1/4" Tie to Exist Main	10	EA	$	$
141	1 1/4" Gate Valve	20	EA	$	$
142	**1" POLYETHYLENE GAS LINE**	300	LF	$	$
143	1" Ell (45 or 90)	5	EA	$	$
144	1" Tee w/reducer, incrs.	5	EA	$	$
145	1" Tie to Exist Main	5	EA	$	$
146	1" Gate Valve	10	EA	$	$
147	**3/4" POLYETHYLENE GAS LINE**	500	LF	$	$
148	3/4" Ell (45 or 90)	10	EA	$	$
149	3/4" Tee w/reducer, incrs.	10	EA	$	$
150	3/4" Tie to Exist Main	5	EA	$	$
151	3/4" Gate Valve	5	EA	$	$
152	2" Gas Stop w/wo Check	10	EA	$	$
153	1 1/2" Gas Stop w/wo Check	10	EA	$	$
154	1 1/4" Gas Stop w/wo Check	10	EA	$	$
155	1" Gas Stop w/wo check	10	EA	$	$
156	Gas Meter Box	10	EA	$	$
157	Valve Box	10	EA	$	$
158	3" Double Check Valve	3	EA	$	$
159	2 1/2" Double Check Valve	4	EA	$	$
160	2" Double Check Valve	5	EA	$	$
161	1 1/2" Double Check Valve	5	EA	$	$
162	1" Double Check Valve	5	EA	$	$
163	1/2" Double Check Valve.	5	EA	$	$
164	Pop-up Head & Nozzle	200	EA	$	$
	low/med volume, PVC				

165	Shrub Spray Head	20	EA	$	$
166	Curb Box	100	EA	$	$
167	Controller: 12 Station	25	EA	$	$
168	Controller: 8 Station	25	EA	$	$
169	Control Wire	6000	LF	$	$
170	Testing & Disinfecting	2	EA	$	$
	IDQ EXCAVATION AND BACKFILL QUANTITIES				
	Utility Trench Excavation **in dirt**				
	Excavate 6" WIDE Trench				
171	@ 12" Deep	12000	LF	$	$
172	@ 18" Deep	2500	LF	$	$
173	@ 24" Deep	2500	LF	$	$
174	@ 36" Deep	2500	LF	$	$
175	@ 48" Deep	3500	LF	$	$
176	@ 60" Deep	4000	LF	$	$
	Backfill 6" WIDE Trench				
177	@ 12" Deep	3500	LF	$	$
178	@ 18" Deep	2500	LF	$	$
179	@ 24" Deep	2500	LF	$	$
180	@ 36" Deep	2500	LF	$	$
181	@ 48" Deep	3500	LF	$	$
182	@ 60" Deep	4000	LF	$	$
183	Exca/Backfill Backhoe 1-4' Deep	2000	CY	$	$
184	" " " 4-6' Deep	2000	CY	$	$
185	" " " 6-10' Deep	3700	CY	$	$
186	" " " 10-14' Deep	3703	CY	$	$
187	" " " 14-16' Deep	3333	CY	$	$
188	Hand Excavate/Backfill	100	CY	$	$
189	Rock Excavation/Backfill	50	CY	$	$
190	Jack/bore 6" Casing/Pipe	500	LF	$	$
191	" " 8" Casing/Pipe	500	LF	$	$

192	" " 10" Casing/Pipe	500	LF	$ _____	$ _____
193	" " 12" Casing/Pipe	500	LF	$ _____	$ _____
194	" " 16" Casing/Pipe	500	LF	$ _____	$ _____
195	Remove Asph Pvmt and Drwy	500	SY	$ _____	$ _____
196	Replace Asph Pvmt and Drwy	500	SY	$ _____	$ _____
197	Remove Conc Pvmt	500	SY	$ _____	$ _____
198	Replace Conc Pvmt	500	SY	$ _____	$ _____
199	Sidewalk Concrete Broom Finish	300	SY	$ _____	$ _____
200	Remove Conc Curb	300	LF	$ _____	$ _____
201	Replace Conc Curb	300	LF	$ _____	$ _____
202	Remove Sidewalk/Driveway	300	SY	$ _____	$ _____
203	Crushed Aggregate Base Course	300	CY	$ _____	$ _____
204	Remove & Repl Flowable Fill	200	CY	$ _____	$ _____
205	Reinforced Steel	800	LB	$ _____	$ _____
206	Sodding 1" Deep	3760	SY	$ _____	$ _____
207	Seeding Bluegrass	1850	SF	$ _____	$ _____
208	Hydromulching	145	MSF	$ _____	$ _____
	IDQ MISCELLANEOUS ITEMS QUANTITIES				
209	Wellpoint Pump Operation	2	EA	$ _____	$ _____
210	Pneumatic Plug	15	EA	$ _____	$ _____
211	By-pass Pumping	15	EA	$ _____	$ _____
212	Water for Cleaning	5000	GAL	$ _____	$ _____
213	Disposal of Wastewater	5000	GAL	$ _____	$ _____
214	Rodding of Sewer	50	HR	$ _____	$ _____
215	Removal Asbestos Pipe	60	LF	$ _____	$ _____
216	Transition Fittings (Poly to Steel)	15	EA	$ _____	$ _____
217	Insert Stiffeners	50	EA	$ _____	$ _____
218	Pipe Wrap, Tape/Primer	2500	LF	$ _____	$ _____
219	Bedding Sand	293	CY	$ _____	$ _____
220	Anodeless Service Riser	30	EA	$ _____	$ _____
221	Regulators	30	EA	$ _____	$ _____
222	Marking Tape	9	ROLL	$ _____	$ _____
223	Soil Density Testing	10	HR	$ _____	$ _____
224	Demo Utility Lines	1500	LF	$ _____	$ _____
225	Per Diem/Man/Day	240	DY	$ _____	$ _____

	MECHANICAL UTILITY SYSTEMS ID/IQ				
	PROPOSED SCHEDULE - OPTION YEAR THREE				
ITEM	DESCRIPTION	EST QTY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
	UNIT PRICE INCLUDES ALL COSTS INCLUDING MATERIAL				
	IDQ WATER/IRRIGATION LINE QUANTITIES				
1	**10" PVC WATER LINE**	2200	LF	$	$
2	10" Ell (45 or 90)	3	EA	$	$
3	10" Tee w/reducer, incrs.	15	EA	$	$
4	10" Cross	2	EA	$	$
5	10" Gate Valve	5	EA	$	$
6	10" Tie to Exist Main	2	EA	$	$
7	10" Hot Tap inc. Valve	1	EA	$	$
8	10" Repair Coupling	3	EA	$	$
9	**8" PVC WATER LINE**	1000	LF	$	$
10	8" Ell (45 OR 90)	8	EA	$	$
11	8"Tee w/reducer, incrs.	8	EA	$	$
12	8" Cross	1	EA	$	$
13	8" Gate Valve	3	EA	$	$
14	8" Tie to Exist Main	5	EA	$	$
15	8" Hot Tap inc. Valve	3	EA	$	$
16	8" Repair Coupling	4	EA	$	$
17	**6" PVC WATER LINE**	500	LF	$	$
18	6" Ell (45 or 90)	5	EA	$	$
19	6" Tee w/reducer, incrs.	5	EA	$	$
20	6" Cross	1	EA	$	$
21	6" Gate Valve	5	EA	$	$
22	6" Tie to Exist Main	4	EA	$	$
23	6" Hot tap inc. valve	4	EA	$	$
24	6" Repair Coupling	3	EA	$	$
25	**4" PVC WATER LINE**	500	LF	$	$
26	4" Ell (45 or 90)	5	EA	$	$

27	4" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
28	4" Cross	3	EA	$ _____	$ _____
29	4" Gate Valve	4	EA	$ _____	$ _____
30	4" Hot Tap Inc. Valve	3	EA	$ _____	$ _____
31	4" Repair Coupling	3	EA	$ _____	$ _____
32	4" Tie to Exist Main	2	EA	$ _____	$ _____
33	4" Check Valve	2	EA	$ _____	$ _____
34	**3" PVC WATER LINE**	800	LF	$ _____	$ _____
35	3" Ell (45 or 90)	60	EA	$ _____	$ _____
36	3" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
37	3" Gate Valve	15	EA	$ _____	$ _____
38	3" Hot Tap inc. Valve	5	EA	$ _____	$ _____
39	3" Compression Coupling	7	EA	$ _____	$ _____
40	3" Check Valve	4	EA	$ _____	$ _____
41	**2 1/2" PVC WATER LINE**	750	LF	$ _____	$ _____
42	2 1/2" Ell (45 or 90)	60	EA	$ _____	$ _____
43	2 1/2" Tee w/reducer, incrs.	30	EA	$ _____	$ _____
44	2 1/2" Cross	5	EA	$ _____	$ _____
45	2 1/2" Gate Valve	12	EA	$ _____	$ _____
46	2 1/2" Tie to Exist Main	7	EA	$ _____	$ _____
47	2 1/2" Hot Tap inc Valve	5	EA	$ _____	$ _____
48	2 1/2" Repair Coupling	5	EA	$ _____	$ _____
49	**2" PVC WATER LINE**	2000	LF	$ _____	$ _____
50	2" Ells (45 or 90)	45	EA	$ _____	$ _____
51	2" Tee w/reducer, incrs.	25	EA	$ _____	$ _____
52	2" Tie to Exist Main	12	EA	$ _____	$ _____
53	2" Gate Valve	40	EA	$ _____	$ _____
54	**1 1/2" PVC WATER LINE**	2800	LF	$ _____	$ _____
55	1 1/2" Ell (45 or 90)	85	EA	$ _____	$ _____
56	1 1/2" Tee w/reducer, incrs.	20	EA	$ _____	$ _____
57	1 1/2" Tie to Exist Main	7	EA	$ _____	$ _____
58	1 1/2" Gate Valve	35	EA	$ _____	$ _____
59	**1 " PVC WATER LINE**	2000	LF	$ _____	$ _____
60	1" Ell (45 or 90)	50	EA	$ _____	$ _____
61	1" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
62	1" Tie to Exist Main	3	EA	$ _____	$ _____
63	1" Gate Valve	10	EA	$ _____	$ _____

64	**1/2" PVC WATER LINE**	2000	LF	$ _____	$ _____
65	1/2" Ell (45 or 90)	75	EA	$ _____	$ _____
66	1/2" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
67	1/2" Gate Valve	20	EA	$ _____	$ _____
68	Repair Cut Sprinkler System	20	EA	$ _____	$ _____
69	Fire Hydrant Assembly	20	EA	$ _____	$ _____
70	Meter Boxes	11	EA	$ _____	$ _____
71	Potable Water Tests	10	EA	$ _____	$ _____
72	Thrust Blocks	100	CY	$ _____	$ _____
73	Valve Boxes	25	EA	$ _____	$ _____
	SANITARY SEWER QUANTITIES				
74	**12" PVC SANITARY SEWER**	100	LF	$ _____	$ _____
75	10" PVC SANITARY SEWER	200	LF	$ _____	$ _____
76	8" PVC SANITARY SEWER	300	LF	$ _____	$ _____
77	6" PVC SANITARY SEWER	400	LF	$ _____	$ _____
78	4" PVC SANITARY SEWER	500	LF	$ _____	$ _____
79	3" PVC SANITARY SEWER	700	LF	$ _____	$ _____
80	Clean lines (3" thru 12")	5000	LF	$ _____	$ _____
	MANHOLE REHABILITATION				
81	Height Adjustment	5	EA	$ _____	$ _____
82	Replace Cover	4	EA	$ _____	$ _____
83	Concrete Ring & Cover	4	EA	$ _____	$ _____
84	Seal Ring & Cover	32	EA	$ _____	$ _____
85	Seal Walls	80	VLF	$ _____	$ _____
86	Reconstruction	30	VLF	$ _____	$ _____
87	Reconstruct Base	5	EA	$ _____	$ _____
88	New Manholes 5' I.D., 4" Deep	3	EA	$ _____	$ _____
89	New Manholes 5' I.D., 6' Deep	7	EA	$ _____	$ _____
90	New Manholes 5' I.D., 8' Deep	21	EA	$ _____	$ _____
91	Greater than 8' (add)	75	VLF	$ _____	$ _____
92	Remove Existing M.H. & Catch Basen	20	EA	$ _____	$ _____
93	Abandon Fill or Grout	100	VLF	$ _____	$ _____
94	Drop Manhole Connection	10	EA	$ _____	$ _____

95	Sanitary Sewer Connection	31	EA	$ _____	$ _____
96	Lateral Repairs	40	LF	$ _____	$ _____
97	Pipe Lining 8", 0' - 299'	100	LF	$ _____	$ _____
98	Pipe Lining 8", 300' - 600'	200	LF	$ _____	$ _____
99	Pipe > Than 600'	300	LF	$ _____	$ _____
100	Reconnection of Services	10	EA	$ _____	$ _____
	IDQ GAS LINE QUANTITIES				
101	10" Hot Tap Including Valve	3	EA	$ _____	$ _____
102	**8" POLYETHYLENE GAS LINE**	1550	LF	$ _____	$ _____
103	8" Ell (45 or 90)	10	EA	$ _____	$ _____
104	8" Tee w/reducer, Incrs,	10	EA	$ _____	$ _____
105	8" Cross	2	EA	$ _____	$ _____
106	8" Gate Valve	4	EA	$ _____	$ _____
107	8" Tie to Exist Main	3	EA	$ _____	$ _____
108	8" Hot Tap inc. valve	3	EA	$ _____	$ _____
109	**6" POLYETHYLENE GAS LINE**	4700	LF	$ _____	$ _____
110	6" Ell (45 or 90)	10	EA	$ _____	$ _____
111	6" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
112	6" Cross	2	EA	$ _____	$ _____
113	6" Gate Valve	5	EA	$ _____	$ _____
114	6" Tie to Exist Main	3	EA	$ _____	$ _____
115	6" Hot Tap inc. Valve	3	EA	$ _____	$ _____
116	**4" POLYETHYLENE GAS LINE**	3370	LF	$ _____	$ _____
117	4" Ell 945 or 90)	10	EA	$ _____	$ _____
118	4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
119	4" Cross	2	EA	$ _____	$ _____
120	4" Gate Valve	10	EA	$ _____	$ _____
121	4" Tie to Exist Main	5	EA	$ _____	$ _____
122	4" Hot Tap inc. Valve	3	EA	$ _____	$ _____
123	4" Service Tie to New Main	3	EA	$ _____	$ _____
124	4" Check Valve	2	EA	$ _____	$ _____
125	**3" POLYETHYLENE GAS LINE**	5449	LF	$ _____	$ _____
126	3" Ell (45 or 90)	10	EA	$ _____	$ _____
127	3" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
128	3" Gate Valve	5	EA	$ _____	$ _____

129	3" Hot Tap inc. Valve	3	EA	$ _____	$ _____
130	3" Compression Coupling	10	EA	$ _____	$ _____
131	3" Check Valve	2	EA	$ _____	$ _____
132	**2" POLYETHYLENE GAS LINE**	1000	LF	$ _____	$ _____
133	2" Ell (B17645 or 90)	15	EA	$ _____	$ _____
134	2" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
135	2" Tie to Exist Main	5	EA	$ _____	$ _____
136	2" Gate Valve	10	EA	$ _____	$ _____
137	**1 1/4" POLYETHYLENE GAS LINE**	350	LF	$ _____	$ _____
138	1 1/4" Ell (45 or 90)	10	EA	$ _____	$ _____
139	1 1/4" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
140	1 1/4" Tie to Exist Main	10	EA	$ _____	$ _____
141	1 1/4" Gate Valve	20	EA	$ _____	$ _____
142	**1" POLYETHYLENE GAS LINE**	300	LF	$ _____	$ _____
143	1" Ell (45 or 90)	5	EA	$ _____	$ _____
144	1" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
145	1" Tie to Exist Main	5	EA	$ _____	$ _____
146	1" Gate Valve	10	EA	$ _____	$ _____
147	**3/4" POLYETHYLENE GAS LINE**	500	LF	$ _____	$ _____
148	3/4" Ell (45 or 90)	10	EA	$ _____	$ _____
149	3/4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
150	3/4" Tie to Exist Main	5	EA	$ _____	$ _____
151	3/4" Gate Valve	5	EA	$ _____	$ _____
152	2" Gas Stop w/wo Check	10	EA	$ _____	$ _____
153	1 1/2" Gas Stop w/wo Check	10	EA	$ _____	$ _____
154	1 1/4" Gas Stop w/wo Check	10	EA	$ _____	$ _____
155	1" Gas Stop w/wo check	10	EA	$ _____	$ _____
156	Gas Meter Box	10	EA	$ _____	$ _____
157	Valve Box	10	EA	$ _____	$ _____
158	3" Double Check Valve	3	EA	$ _____	$ _____
159	2 1/2" Double Check Valve	4	EA	$ _____	$ _____
160	2" Double Check Valve	5	EA	$ _____	$ _____
161	1 1/2" Double Check Valve	5	EA	$ _____	$ _____
162	1" Double Check Valve	5	EA	$ _____	$ _____
163	1/2" Double Check Valve.	5	EA	$ _____	$ _____
164	Pop-up Head & Nozzle	200	EA	$ _____	$ _____
	low/med volume, PVC				

165	Shrub Spray Head	20	EA	$ _____	$ _____
166	Curb Box	100	EA	$ _____	$ _____
167	Controller: 12 Station	25	EA	$ _____	$ _____
168	Controller: 8 Station	25	EA	$ _____	$ _____
169	Control Wire	6000	LF	$ _____	$ _____
170	Testing & Disinfecting	2	EA	$ _____	$ _____
	IDQ EXCAVATION AND BACKFILL QUANTITIES				
	Utility Trench Excavation **in dirt**				
	Excavate 6" WIDE Trench				
171	@ 12" Deep	12000	LF	$ _____	$ _____
172	@ 18" Deep	2500	LF	$ _____	$ _____
173	@ 24" Deep	2500	LF	$ _____	$ _____
174	@ 36" Deep	2500	LF	$ _____	$ _____
175	@ 48" Deep	3500	LF	$ _____	$ _____
176	@ 60" Deep	4000	LF	$ _____	$ _____
	Backfill 6" WIDE Trench				
177	@ 12" Deep	3500	LF	$ _____	$ _____
178	@ 18" Deep	2500	LF	$ _____	$ _____
179	@ 24" Deep	2500	LF	$ _____	$ _____
180	@ 36" Deep	2500	LF	$ _____	$ _____
181	@ 48" Deep	3500	LF	$ _____	$ _____
182	@ 60" Deep	4000	LF	$ _____	$ _____
183	Exca/Backfill Backhoe 1-4' Deep	2000	CY	$ _____	$ _____
184	" " " 4-6' Deep	2000	CY	$ _____	$ _____
185	" " " 6-10' Deep	3700	CY	$ _____	$ _____
186	" " " 10-14' Deep	3703	CY	$ _____	$ _____
187	" " " 14-16' Deep	3333	CY	$ _____	$ _____
188	Hand Excavate/Backfill	100	CY	$ _____	$ _____
189	Rock Excavation/Backfill	50	CY	$ _____	$ _____
190	Jack/bore 6" Casing/Pipe	500	LF	$ _____	$ _____
191	" " 8" Casing/Pipe	500	LF	$ _____	$ _____

192	" " 10" Casing/Pipe	500	LF	$ _____	$ _____
193	" " 12" Casing/Pipe	500	LF	$ _____	$ _____
194	" " 16" Casing/Pipe	500	LF	$ _____	$ _____
195	Remove Asph Pvmt and Drwy	500	SY	$ _____	$ _____
196	Replace Asph Pvmt and Drwy	500	SY	$ _____	$ _____
197	Remove Conc Pvmt	500	SY	$ _____	$ _____
198	Replace Conc Pvmt	500	SY	$ _____	$ _____
199	Sidewalk Concrete Broom Finish	300	SY	$ _____	$ _____
200	Remove Conc Curb	300	LF	$ _____	$ _____
201	Replace Conc Curb	300	LF	$ _____	$ _____
202	Remove Sidewalk/Driveway	300	SY	$ _____	$ _____
203	Crushed Aggregate Base Course	300	CY	$ _____	$ _____
204	Remove & Repl Flowable Fill	200	CY	$ _____	$ _____
205	Reinforced Steel	800	LB	$ _____	$ _____
206	Sodding 1" Deep	3760	SY	$ _____	$ _____
207	Seeding Bluegrass	1850	SF	$ _____	$ _____
208	Hydromulching	145	MSF	$ _____	$ _____
	IDQ MISCELLANEOUS ITEMS QUANTITIES				
209	Wellpoint Pump Operation	2	EA	$ _____	$ _____
210	Pneumatic Plug	15	EA	$ _____	$ _____
211	By-pass Pumping	15	EA	$ _____	$ _____
212	Water for Cleaning	5000	GAL	$ _____	$ _____
213	Disposal of Wastewater	5000	GAL	$ _____	$ _____
214	Rodding of Sewer	50	HR	$ _____	$ _____
215	Removal Asbestos Pipe	60	LF	$ _____	$ _____
216	Transition Fittings (Poly to Steel)	15	EA	$ _____	$ _____
217	Insert Stiffeners	50	EA	$ _____	$ _____
218	Pipe Wrap, Tape/Primer	2500	LF	$ _____	$ _____
219	Bedding Sand	293	CY	$ _____	$ _____
220	Anodeless Service Riser	30	EA	$ _____	$ _____
221	Regulators	30	EA	$ _____	$ _____
222	Marking Tape	9	ROLL	$ _____	$ _____
223	Soil Density Testing	10	HR	$ _____	$ _____
224	Demo Utility Lines	1500	LF	$ _____	$ _____
225	Per Diem/Man/Day	240	DY	$ _____	$ _____

MECHANICAL UTILITY SYSTEMS ID/IQ

PROPOSED SCHEDULE - OPTION YEAR FOUR

ITEM	DESCRIPTION	EST QTY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
UNIT PRICE INCLUDES ALL COSTS INCLUDING MATERIAL					
	IDQ WATER/IRRIGATION LINE QUANTITIES				
1	**10" PVC WATER LINE**	2200	LF	$	$
2	10" Ell (45 or 90)	3	EA	$	$
3	10" Tee w/reducer, incrs.	15	EA	$	$
4	10" Cross	2	EA	$	$
5	10" Gate Valve	5	EA	$	$
6	10" Tie to Exist Main	2	EA	$	$
7	10" Hot Tap inc. Valve	1	EA	$	$
8	10" Repair Coupling	3	EA	$	$
9	**8" PVC WATER LINE**	1000	LF	$	$
10	8" Ell (45 OR 90)	8	EA	$	$
11	8"Tee w/reducer, incrs.	8	EA	$	$
12	8" Cross	1	EA	$	$
13	8" Gate Valve	3	EA	$	$
14	8" Tie to Exist Main	5	EA	$	$
15	8" Hot Tap inc. Valve	3	EA	$	$
16	8" Repair Coupling	4	EA	$	$
17	**6" PVC WATER LINE**	500	LF	$	$
18	6" Ell (45 or 90)	5	EA	$	$
19	6" Tee w/reducer, incrs.	5	EA	$	$
20	6" Cross	1	EA	$	$
21	6" Gate Valve	5	EA	$	$
22	6" Tie to Exist Main	4	EA	$	$
23	6" Hot tap inc. valve	4	EA	$	$
24	6" Repair Coupling	3	EA	$	$
25	**4" PVC WATER LINE**	500	LF	$	$
26	4" Ell (45 or 90)	5	EA	$	$

27	4" Tee w/reducer, incrs.	5	EA	$ _____	$ _____
28	4" Cross	3	EA	$ _____	$ _____
29	4" Gate Valve	4	EA	$ _____	$ _____
30	4" Hot Tap Inc. Valve	3	EA	$ _____	$ _____
31	4" Repair Coupling	3	EA	$ _____	$ _____
32	4" Tie to Exist Main	2	EA	$ _____	$ _____
33	4" Check Valve	2	EA	$ _____	$ _____
34	**3" PVC WATER LINE**	800	LF	$ _____	$ _____
35	3" Ell (45 or 90)	60	EA	$ _____	$ _____
36	3" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
37	3" Gate Valve	15	EA	$ _____	$ _____
38	3" Hot Tap inc. Valve	5	EA	$ _____	$ _____
39	3" Compression Coupling	7	EA	$ _____	$ _____
40	3" Check Valve	4	EA	$ _____	$ _____
41	**2 1/2" PVC WATER LINE**	750	LF	$ _____	$ _____
42	2 1/2" Ell (45 or 90)	60	EA	$ _____	$ _____
43	2 1/2" Tee w/reducer, incrs.	30	EA	$ _____	$ _____
44	2 1/2" Cross	5	EA	$ _____	$ _____
45	2 1/2" Gate Valve	12	EA	$ _____	$ _____
46	2 1/2" Tie to Exist Main	7	EA	$ _____	$ _____
47	2 1/2" Hot Tap inc Valve	5	EA	$ _____	$ _____
48	2 1/2" Repair Coupling	5	EA	$ _____	$ _____
49	**2" PVC WATER LINE**	2000	LF	$ _____	$ _____
50	2" Ells (45 or 90)	45	EA	$ _____	$ _____
51	2" Tee w/reducer, incrs.	25	EA	$ _____	$ _____
52	2" Tie to Exist Main	12	EA	$ _____	$ _____
53	2" Gate Valve	40	EA	$ _____	$ _____
54	**1 1/2" PVC WATER LINE**	2800	LF	$ _____	$ _____
55	1 1/2" Ell (45 or 90)	85	EA	$ _____	$ _____
56	1 1/2" Tee w/reducer, incrs.	20	EA	$ _____	$ _____
57	1 1/2" Tie to Exist Main	7	EA	$ _____	$ _____
58	1 1/2" Gate Valve	35	EA	$ _____	$ _____
59	**1 " PVC WATER LINE**	2000	LF	$ _____	$ _____
60	1" Ell (45 or 90)	50	EA	$ _____	$ _____
61	1" Tee w/reducer, incrs.	15	EA	$ _____	$ _____
62	1" Tie to Exist Main	3	EA	$ _____	$ _____
63	1" Gate Valve	10	EA	$ _____	$ _____

64	**1/2" PVC WATER LINE**	2000	LF	$ _____	$ _____
65	1/2" Ell (45 or 90)	75	EA	$ _____	$ _____
66	1/2" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
67	1/2" Gate Valve	20	EA	$ _____	$ _____
68	Repair Cut Sprinkler System	20	EA	$ _____	$ _____
69	Fire Hydrant Assembly	20	EA	$ _____	$ _____
70	Meter Boxes	11	EA	$ _____	$ _____
71	Potable Water Tests	10	EA	$ _____	$ _____
72	Thrust Blocks	100	CY	$ _____	$ _____
73	Valve Boxes	25	EA	$ _____	$ _____
	SANITARY SEWER QUANTITIES				
74	**12" PVC SANITARY SEWER**	100	LF	$ _____	$ _____
75	10" PVC SANITARY SEWER	200	LF	$ _____	$ _____
76	8" PVC SANITARY SEWER	300	LF	$ _____	$ _____
77	6" PVC SANITARY SEWER	400	LF	$ _____	$ _____
78	4" PVC SANITARY SEWER	500	LF	$ _____	$ _____
79	3" PVC SANITARY SEWER	700	LF	$ _____	$ _____
80	Clean lines (3" thru 12")	5000	LF	$ _____	$ _____
	MANHOLE REHABILITATION				
81	Height Adjustment	5	EA	$ _____	$ _____
82	Replace Cover	4	EA	$ _____	$ _____
83	Concrete Ring & Cover	4	EA	$ _____	$ _____
84	Seal Ring & Cover	32	EA	$ _____	$ _____
85	Seal Walls	80	VLF	$ _____	$ _____
86	Reconstruction	30	VLF	$ _____	$ _____
87	Reconstruct Base	5	EA	$ _____	$ _____
88	New Manholes 5' I.D., 4" Deep	3	EA	$ _____	$ _____
89	New Manholes 5' I.D., 6' Deep	7	EA	$ _____	$ _____
90	New Manholes 5' I.D., 8' Deep	21	EA	$ _____	$ _____
91	Greater than 8' (add)	75	VLF	$ _____	$ _____
92	Remove Existing M.H. Catch Basen	20	EA	$ _____	$ _____
93	Abandon Fill or Grout	100	VLF	$ _____	$ _____
94	Drop Manhole Connection	10	EA	$ _____	$ _____

95	Sanitary Sewer Connection	31	EA	$ _____	$ _____
96	Lateral Repairs	40	LF	$ _____	$ _____
97	Pipe Lining 8", 0' - 299'	100	LF	$ _____	$ _____
98	Pipe Lining 8", 300' - 600'	200	LF	$ _____	$ _____
99	Pipe > Than 600'	300	LF	$ _____	$ _____
100	Reconnection of Services	10	EA	$ _____	$ _____
	IDQ GAS LINE QUANTITIES				
101	10" Hot Tap Including Valve	3	EA	$ _____	$ _____
102	**8" POLYETHYLENE GAS LINE**	1550	LF	$ _____	$ _____
103	8" Ell (45 or 90)	10	EA	$ _____	$ _____
104	8" Tee w/reducer, Incrs,	10	EA	$ _____	$ _____
105	8" Cross	2	EA	$ _____	$ _____
106	8" Gate Valve	4	EA	$ _____	$ _____
107	8" Tie to Exist Main	3	EA	$ _____	$ _____
108	8" Hot Tap inc. valve	3	EA	$ _____	$ _____
109	**6" POLYETHYLENE GAS LINE**	4700	LF	$ _____	$ _____
110	6" Ell (45 or 90)	10	EA	$ _____	$ _____
111	6" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
112	6" Cross	2	EA	$ _____	$ _____
113	6" Gate Valve	5	EA	$ _____	$ _____
114	6" Tie to Exist Main	3	EA	$ _____	$ _____
115	6" Hot Tap inc. Valve	3	EA	$ _____	$ _____
116	**4" POLYETHYLENE GAS LINE**	3370	LF	$ _____	$ _____
117	4" Ell 945 or 90)	10	EA	$ _____	$ _____
118	4" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
119	4" Cross	2	EA	$ _____	$ _____
120	4" Gate Valve	10	EA	$ _____	$ _____
121	4" Tie to Exist Main	5	EA	$ _____	$ _____
122	4" Hot Tap inc. Valve	3	EA	$ _____	$ _____
123	4" Service Tie to New Main	3	EA	$ _____	$ _____
124	4" Check Valve	2	EA	$ _____	$ _____
125	**3" POLYETHYLENE GAS LINE**	5449	LF	$ _____	$ _____
126	3" Ell (45 or 90)	10	EA	$ _____	$ _____
127	3" Tee w/reducer, incrs.	10	EA	$ _____	$ _____
128	3" Gate Valve	5	EA	$ _____	$ _____

129	3" Hot Tap inc. Valve	3	EA	$	$
130	3" Compression Coupling	10	EA	$	$
131	3" Check Valve	2	EA	$	$
132	**2" POLYETHYLENE GAS LINE**	1000	LF	$	$
133	2" Ell (45 or 90)	15	EA	$	$
134	2" Tee w/reducer, incrs.	5	EA	$	$
135	2" Tie to Exist Main	5	EA	$	$
136	2" Gate Valve	10	EA	$	$
137	**1 1/4" POLYETHYLENE GAS LINE**	350	LF	$	$
138	1 1/4" Ell (45 or 90)	10	EA	$	$
139	1 1/4" Tee w/reducer, incrs.	5	EA	$	$
140	1 1/4" Tie to Exist Main	10	EA	$	$
141	1 1/4" Gate Valve	20	EA	$	$
142	**1" POLYETHYLENE GAS LINE**	300	LF	$	$
143	1" Ell (45 or 90)	5	EA	$	$
144	1" Tee w/reducer, incrs.	5	EA	$	$
145	1" Tie to Exist Main	5	EA	$	$
146	1" Gate Valve	10	EA	$	$
147	**3/4" POLYETHYLENE GAS LINE**	500	LF	$	$
148	3/4" Ell (45 or 90)	10	EA	$	$
149	3/4" Tee w/reducer, incrs.	10	EA	$	$
150	3/4" Tie to Exist Main	5	EA	$	$
151	3/4" Gate Valve	5	EA	$	$
152	2" Gas Stop w/wo Check	10	EA	$	$
153	1 1/2" Gas Stop w/wo Check	10	EA	$	$
154	1 1/4" Gas Stop w/wo Check	10	EA	$	$
155	1" Gas Stop w/wo check	10	EA	$	$
156	Gas Meter Box	10	EA	$	$
157	Valve Box	10	EA	$	$
158	3" Double Check Valve	3	EA	$	$
159	2 1/2" Double Check Valve	4	EA	$	$
160	2" Double Check Valve	5	EA	$	$
161	1 1/2" Double Check Valve	5	EA	$	$
162	1" Double Check Valve	5	EA	$	$
163	1/2" Double Check Valve.	5	EA	$	$
164	Pop-up Head & Nozzle	200	EA	$	$
	low/med volume, PVC				

165	Shrub Spray Head	20	EA	$	$
166	Curb Box	100	EA	$	$
167	Controller: 12 Station	25	EA	$	$
168	Controller: 8 Station	25	EA	$	$
169	Control Wire	6000	LF	$	$
170	Testing & Disinfecting	2	EA	$	$
	IDQ EXCAVATION AND BACKFILL QUANTITIES				
	Utility Trench Excavation **in dirt**				
	Excavate 6" WIDE Trench				
171	@ 12" Deep	12000	LF	$	$
172	@ 18" Deep	2500	LF	$	$
173	@ 24" Deep	2500	LF	$	$
174	@ 36" Deep	2500	LF	$	$
175	@ 48" Deep	3500	LF	$	$
176	@ 60" Deep	4000	LF	$	$
	Backfill 6" WIDE Trench				
177	@ 12" Deep	3500	LF	$	$
178	@ 18" Deep	2500	LF	$	$
179	@ 24" Deep	2500	LF	$	$
180	@ 36" Deep	2500	LF	$	$
181	@ 48" Deep	3500	LF	$	$
182	@ 60" Deep	4000	LF	$	$
183	Exca/Backfill Backhoe 1-4' Deep	2000	CY	$	$
184	" " " 4-6' Deep	2000	CY	$	$
185	" " " 6-10' Deep	3700	CY	$	$
186	" " " 10-14' Deep	3703	CY	$	$
187	" " " 14-16' Deep	3333	CY	$	$
188	Hand Excavate/Backfill	100	CY	$	$
189	Rock Excavation/Backfill	50	CY	$	$
190	Jack/bore 6" Casing/Pipe	500	LF	$	$
191	" " 8" Casing/Pipe	500	LF	$	$

192	" " 10" Casing/Pipe	500	LF	$ _____	$ _____
193	" " 12" Casing/Pipe	500	LF	$ _____	$ _____
194	" " 16" Casing/Pipe	500	LF	$ _____	$ _____
195	Remove Asph Pvmt and Drwy	500	SY	$ _____	$ _____
196	Replace Asph Pvmt and Drwy	500	SY	$ _____	$ _____
197	Remove Conc Pvmt	500	SY	$ _____	$ _____
198	Replace Conc Pvmt	500	SY	$ _____	$ _____
199	Sidewalk Concrete Broom Finish	300	SY	$ _____	$ _____
200	Remove Conc Curb	300	LF	$ _____	$ _____
201	Replace Conc Curb	300	LF	$ _____	$ _____
202	Remove Sidewalk/Driveway	300	SY	$ _____	$ _____
203	Crushed Aggregate Base Course	300	CY	$ _____	$ _____
204	Remove & Repl Flowable Fill	200	CY	$ _____	$ _____
205	Reinforced Steel	800	LB	$ _____	$ _____
206	Sodding 1" Deep	3760	SY	$ _____	$ _____
207	Seeding Bluegrass	1850	SF	$ _____	$ _____
208	Hydromulching	145	MSF	$ _____	$ _____
	IDQ MISCELLANEOUS ITEMS QUANTITIES				
209	Wellpoint Pump Operation	2	EA	$ _____	$ _____
210	Pneumatic Plug	15	EA	$ _____	$ _____
211	By-pass Pumping	15	EA	$ _____	$ _____
212	Water for Cleaning	5000	GAL	$ _____	$ _____
213	Disposal of Wastewater	5000	GAL	$ _____	$ _____
214	Rodding of Sewer	50	HR	$ _____	$ _____
215	Removal Asbestos Pipe	60	LF	$ _____	$ _____
216	Transition Fittings (Poly to Steel)	15	EA	$ _____	$ _____
217	Insert Stiffeners	50	EA	$ _____	$ _____
218	Pipe Wrap, Tape/Primer	2500	LF	$ _____	$ _____
219	Bedding Sand	293	CY	$ _____	$ _____
220	Anodeless Service Riser	30	EA	$ _____	$ _____
221	Regulators	30	EA	$ _____	$ _____
222	Marking Tape	9	ROLL	$ _____	$ _____
223	Soil Density Testing	10	HR	$ _____	$ _____
224	Demo Utility Lines	1500	LF	$ _____	$ _____
225	Per Diem/Man/Day	240	DY	$ _____	$ _____